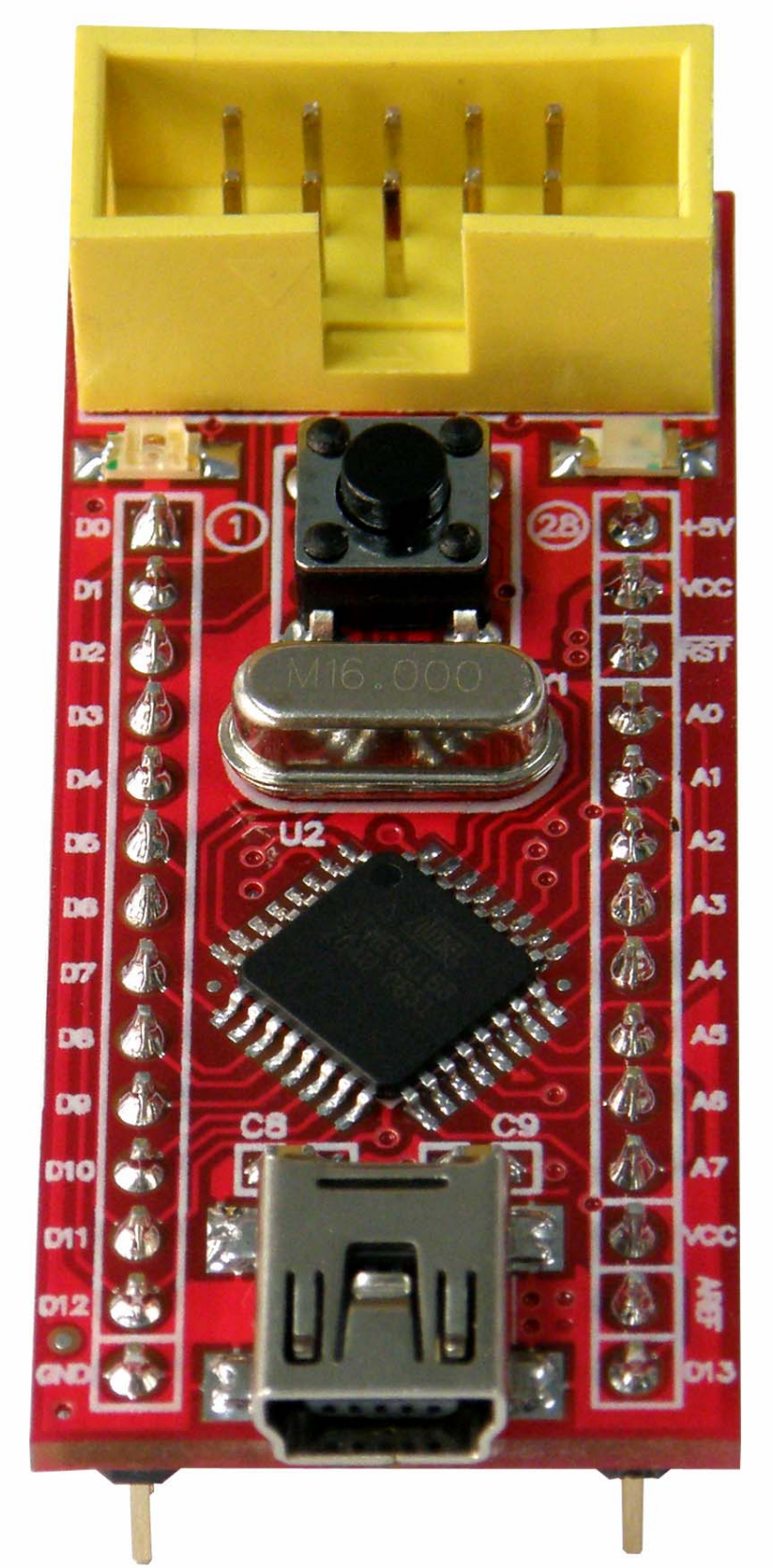
ET-EASY168 STAMP



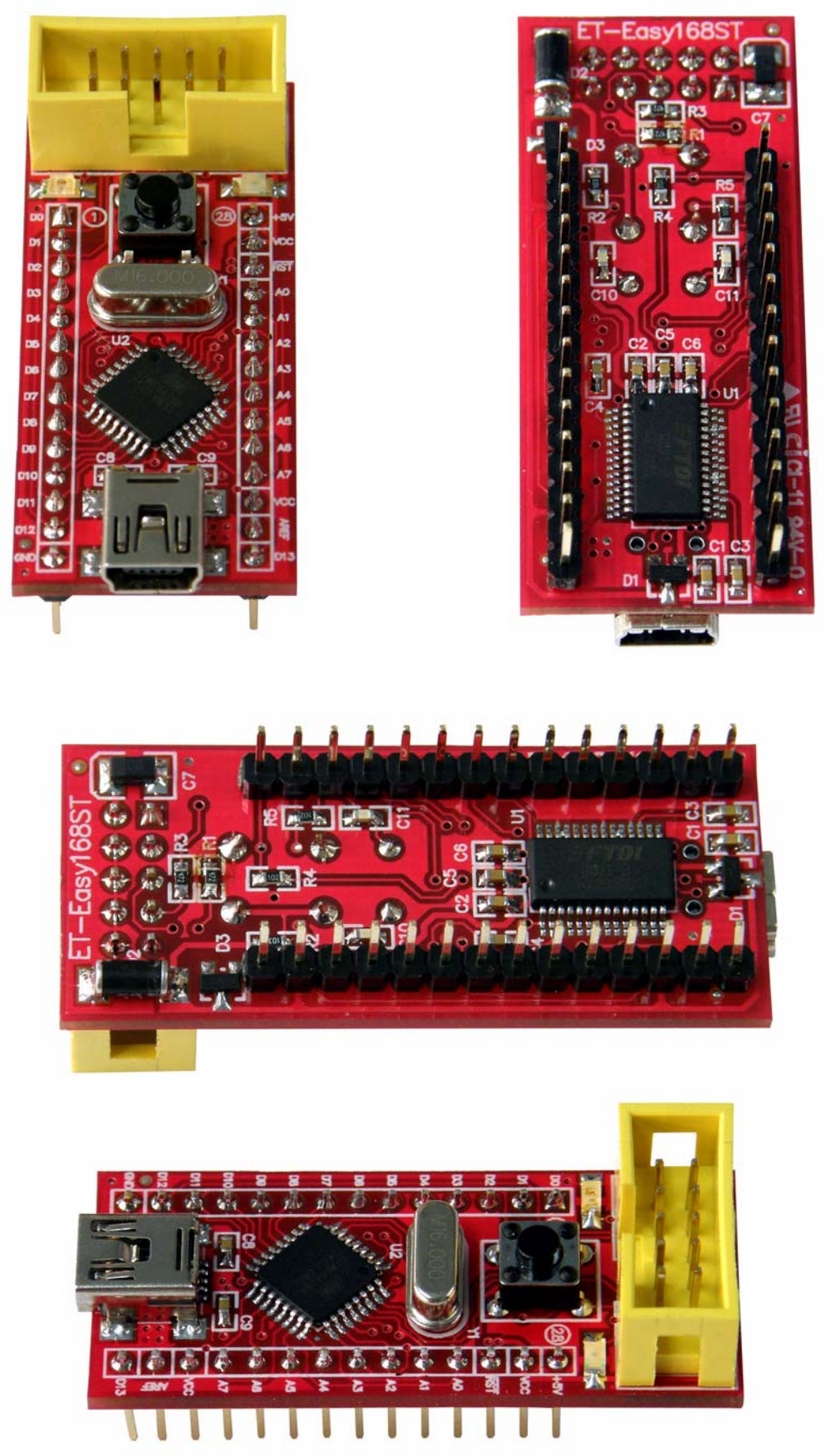
Picture displays structure of Board ET-EASY168 STAMP.

ET-EASY168 STAMP is mini AVR8 Board Microcontroller that only is 2cm x 5cm or it is equivalent to IC 28 DIP 300. It uses AVR8 Microcontroller No.ATmega168 of ATMEL to be MCU on board. This MCU is 32 TQFP and it includes the necessary peripheral devices such as Oscillator and Reset internal board. Moreover, internal board includes IC USB Bridge No.FT232R of FTDI to be RS232 Serial Communication between board and computer PC through Port USB directly.

So, this Board ET-EASY168 STAMP is the mini training board that is full of the necessary peripheral devices for operations of AVR8 Microcontroller. It only interfaces USB Cable from Port USB of computer PC with USB Connector of Board ET-EASY168 STAMP, it makes user can write program and download Code into MCU to experiment instantly.

Specifications of Board

- Use AVR8 MCU No.ATmega168 of ATMEL and run with frequency 16 MHz.
    - Has 16KByte Flash Memory to write program if developing program through AVRISP System; or 14KByte Flash Memory if developing program through Boot Loader RS232.
    - Has 1KByte SRAM and 512Byte EEPROM
    - Has 22Bit GPIO
        - 14Bit Digital GPIO
        - 10Bit 8-Channel Analog Input (ADC)
- Use +5VDC Power Supply; both +5VDC/500mA from Port USB and +5VDC from external. There is LED Power to display status of Power Supply.
- Has External Reset Circuit that is RC Reset and Switch Reset internal board.
- Place Connector on Pin Header with 2.54mm(100mil) width, 28Pin (14Pin per each side) with 600mil(1.5cm) width, so it is easy to apply and expand I/O circuit. Moreover, it can be used with Project Board and all-purpose PCB easily.
- Has USB Connector to interface with computer PC through USB Bridge of FTDI in the format of RS232 Serial Communication; in this case, it is used to communicate and download Code into MCU on board.
- Has IDE 10PIN AVRISP Connector to download program into MCU internal board if not developing program through Boot Loader.
- Has LED to display status that connects with PB5 of AVR (Digital-13 of Arduino Project) to be the simple testing device.



Picture displays features of Board ET-EASY168 STAMP.

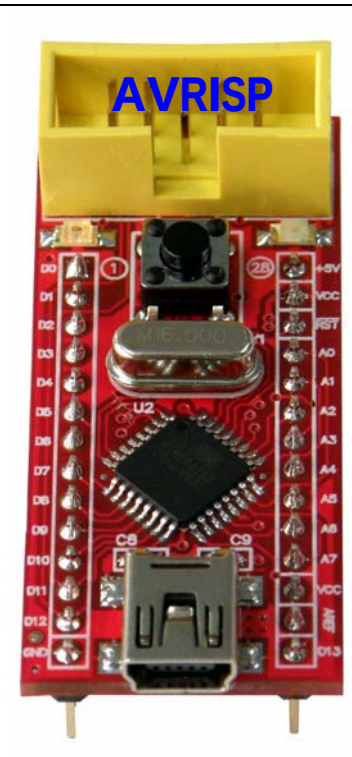
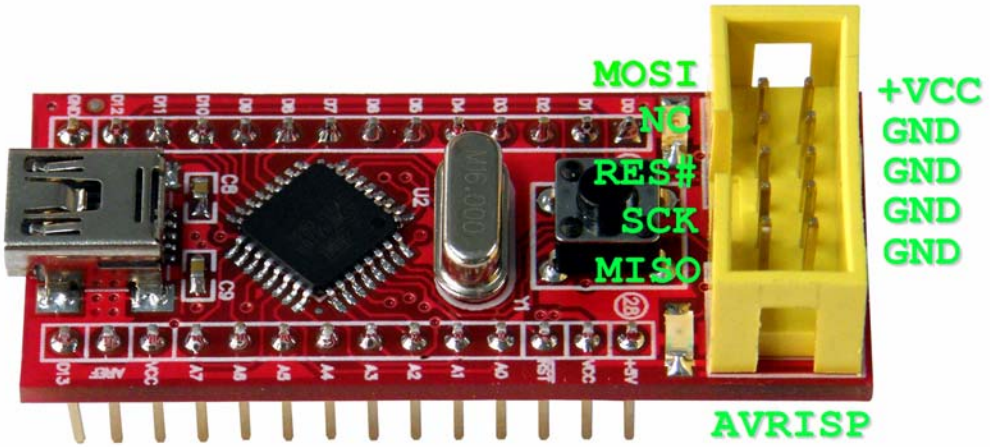
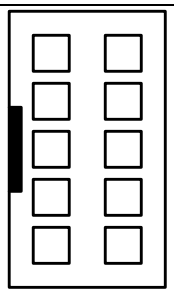
AVR	Arduino	Pin	ET-EASY168 STAMP	Pin	Arduino	AVR
PD0	Digital-0	1		28	+5V(+Vin)	+5V(+Vin)
PD1	Digital-1	2		27	+VCC(+5V)	+VCC(+5V)
PD2	Digital-2	3		26	RESET#	RESET(PC6)
PD3	Digital-3	4		25	Analog-0	PC0/ADC0
PD4	Digital-4	5		24	Analog-1	PC1/ADC1
PD5	Digital-5	6		23	Analog-2	PC2/ADC2
PD6	Digital-6	7		22	Analog-3	PC3/ADC3
PD7	Digital-7	8		21	Analog-4	PC4/ADC4
PB0	Digital-8	9		20	Analog-5	PC5/ADC5
PB1	Digital-9	10		19	Analog-6	ADC6
PB2	Digital-10	11		18	Analog-7	ADC7
PB3	Digital-11	12		17	+VCC(+5V)	+VCC(+5V)
PB4	Digital-12	13		16	+AREF	+AREF
GND	GND	14		15	Digital-13	PB5

Table shows Pin Arrangement of Board ET-EASY168 STAMP.



AVR	Arduino	Pin	AVRISP	Pin	Arduino	AVR
PB3	Digital-11	MOSI		+VCC	+VCC	+VCC
-	-	NC		GND	GND	GND
RES#	RES#	RES#		GND	GND	GND
PB5	Digital-13	SCK		GND	GND	GND
PB4	Digital-12	MISO		GND	GND	GND

Function of Signal Pins When Using As "Arduino Project"

- **+5V(+Vin):** This pin receives external +5VDC Power Supply to be Power Supply of board.
- **+VCC(+5V):** This pin is Power Supply in the same point of supplying power to +VCC of MCU. This point receives voltage from 2 sources; Pin **+5V(+Vin)** from Pin 28 of Board and Pin **+VUSB(+5V**) from USB Connector of board. In this case, there is Diode to protect voltage from reverse.
- **+AREF**: This pin receives Signal Reference Voltage (Analog Reference) for Analog Input Circuit if using external Reference Voltage.
- **RESET#:** It is RESET Pin of CPU that runs at Logic "0".
- **Digital[0..13]:** It is Digital I/O Pin that can be connected with Signal Logic TTL (5V).
- **Analog[0..7]:** It is Analog Input Pin that can receive Analog Input in the range of 0..+5V.

Function of Signal Pins When Using As "AVR Micro Controller"

- **+5V(+Vin):** This pin receives external +5VDC Power Supply to be Power Supply of Board.
- **+VCC(+5V):** This pin is Power Supply in the same point of supplying to +VCC of MCU. This point receives voltage from 2 sources; Pin **+5V(+Vin)** from Pin 28 of Board and Pin **+VUSB(+5V)** from USB Connector of board. In this case, there is Diode to protect voltage from reverse.
- **+AREF**: This pin receives Signal Reference Voltage (Analog Reference) for Analog Input Circuit if using external Reference Voltage.
- **RESET#:** It is RESET Pin of CPU that runs at Logic "0".
- **PB[0..5]:** It is Digital I/O Pin that can be connected with signal Logic TTL (5V).
- **PD[0..7]:** It is Digital I/O Pin that can be connected with signal Logic TTL (5V).
- **PC[0..5]:** It is I/O Pin that can be set both Digital and Analog Input.
- **ADC6,ADC7:** It is Analog Input Pin that can receive Analog Input in the range of 0..+5V.

Program Development of Board ET-EASY168 STAMP

There are 2 types to develop program of Board ET-EASY168 STAMP as follows;

- **AVR Micro Controller:** It develops program in the format of normal AVR Micro Controller. In this case, we can use any language program that supports AVR No.ATmega168; so, it depends on the skill of user to choose the desired language for developing program such as BASIC Language BASCOM-AVR or C Language such as Code Vision and WinAVR.

- **Arduino Project**: It uses program and instruction set of C Language (C++) of "Arduino Project" to write program for program development. It is the project to develop AVR Microcontroller as Open Source that is popular nowadays because it reveals all Source Code of program development. Moreover, there are examples of Development Project for userd to learn, study and test free without any charge. User can see more information about this Arduino Project from **http://www.arduino.cc/**

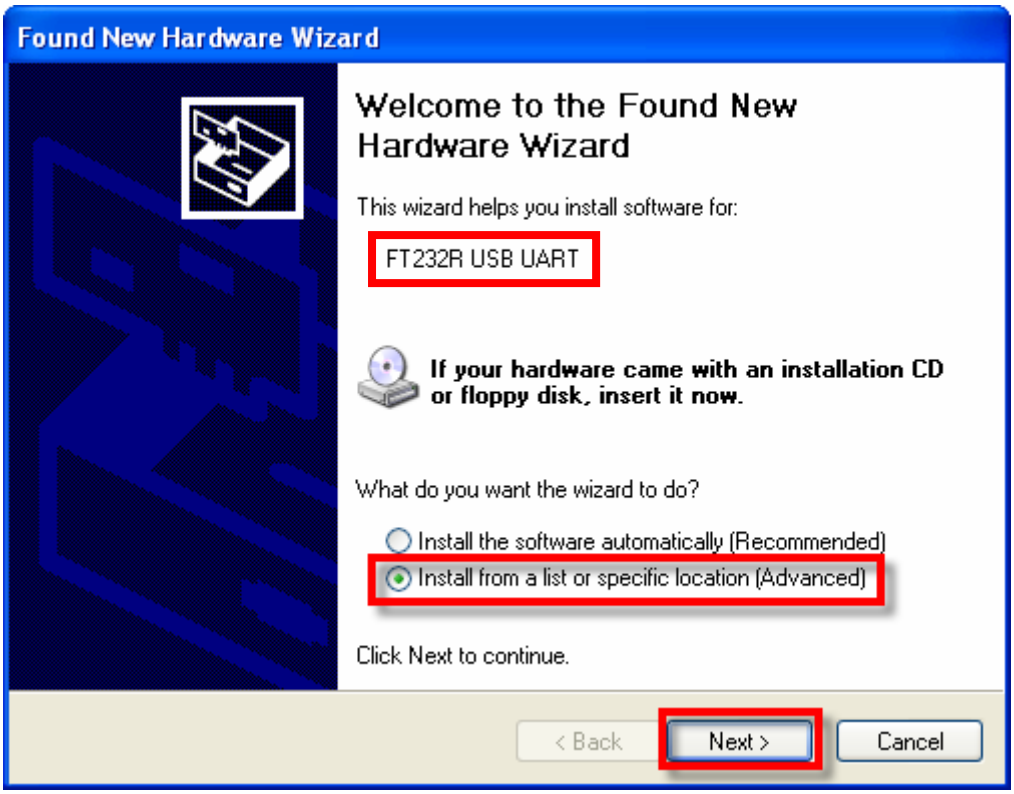
****

Driver Installation of USB Bridge for Board ET-EASY168 STAMP

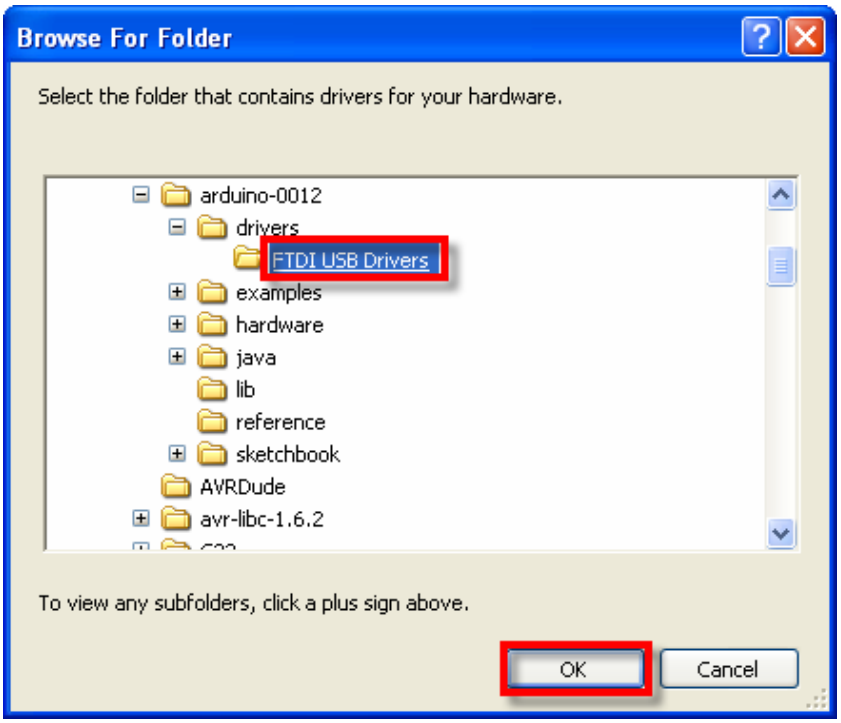
Board ET-EASY168 STAMP uses Chip USB Bridge of FTDI to be the intermediary for connecting and communicating between Computer PC and MCU ATmega168 of Board ET-EASY168 STAMP in the format of Serial Port (Visual Com Port). Program Applications that run on computer PC, including Program Arduino will see Port USB that is connected with Board ET-EASY168 STAMP as a channel of Serial Port Communication (Com Port) only. If computer PC of user has already been installed Driver for USB Bridge of FTDI completely, Windows will automatically install Driver when connecting USB Cable of Board ET-EASY168 STAMP with USB HUB of Computer PC. On other hand, if Computer PC has never been installed any Driver of FTDI before, user has to install Driver into Board first as following procedures below;

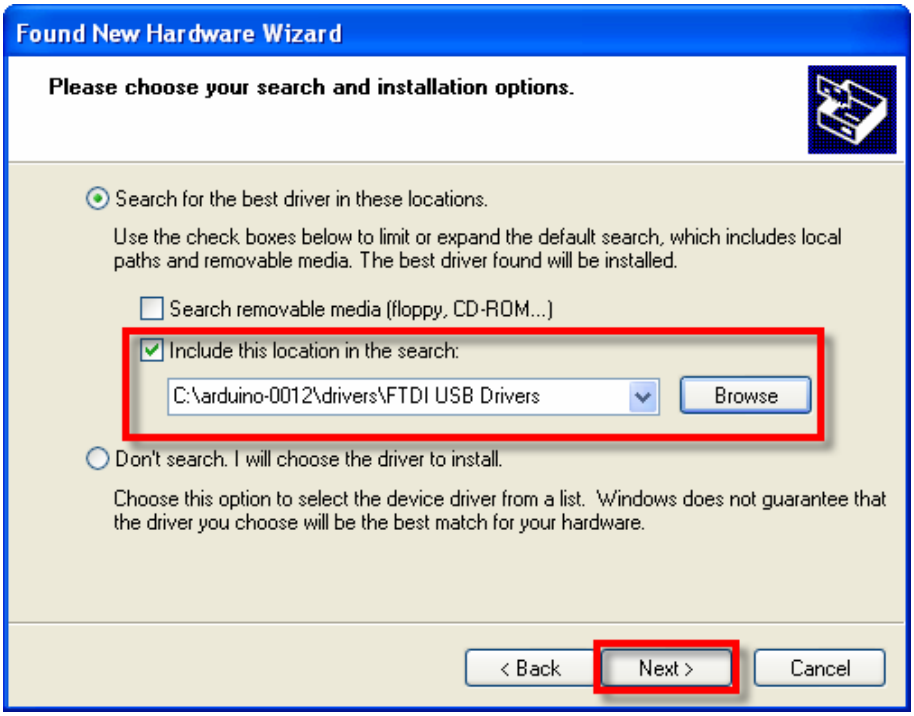
1. Prepare CD-ROM that contains Driver of FTDI; or if user has already installed Program of Arduino completely, there is Driver of FTDI internal folder of Program Arduino in **"C:\arduino-0012\drivers\FTDI USB Drivers\".**

2. Interface USB Cable of Board ET-EASY168 STAMP with Port USB HUB of Computer PC, Windows will find the new device that is **"FT232R USB UART"** and then notify user to install Driver into the device as shown below;

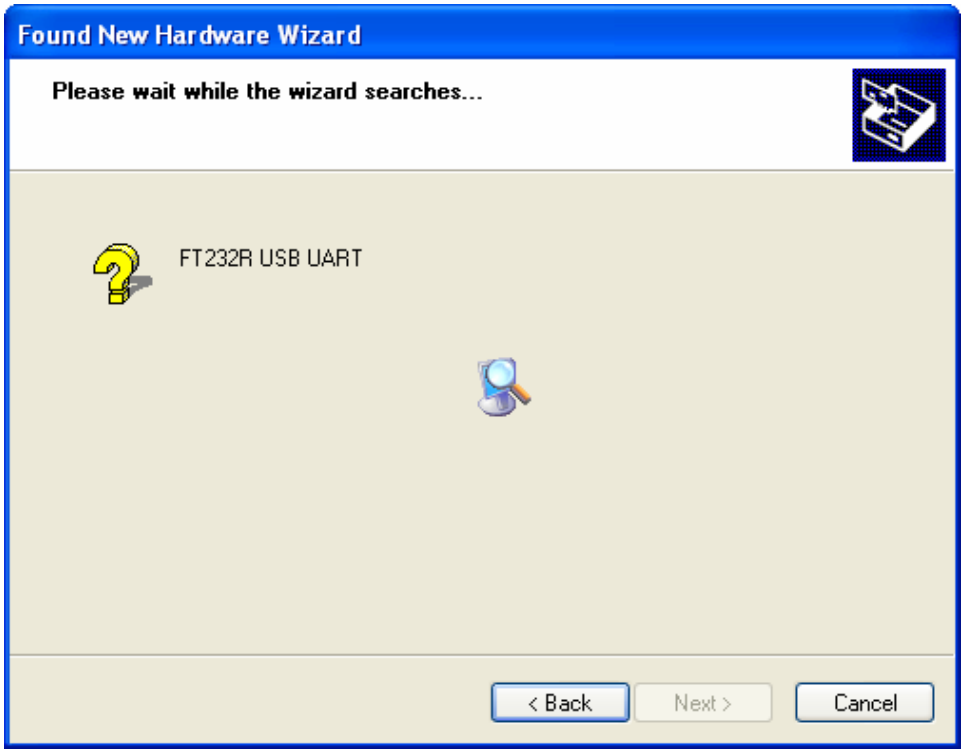

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
FT232R USB UART
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

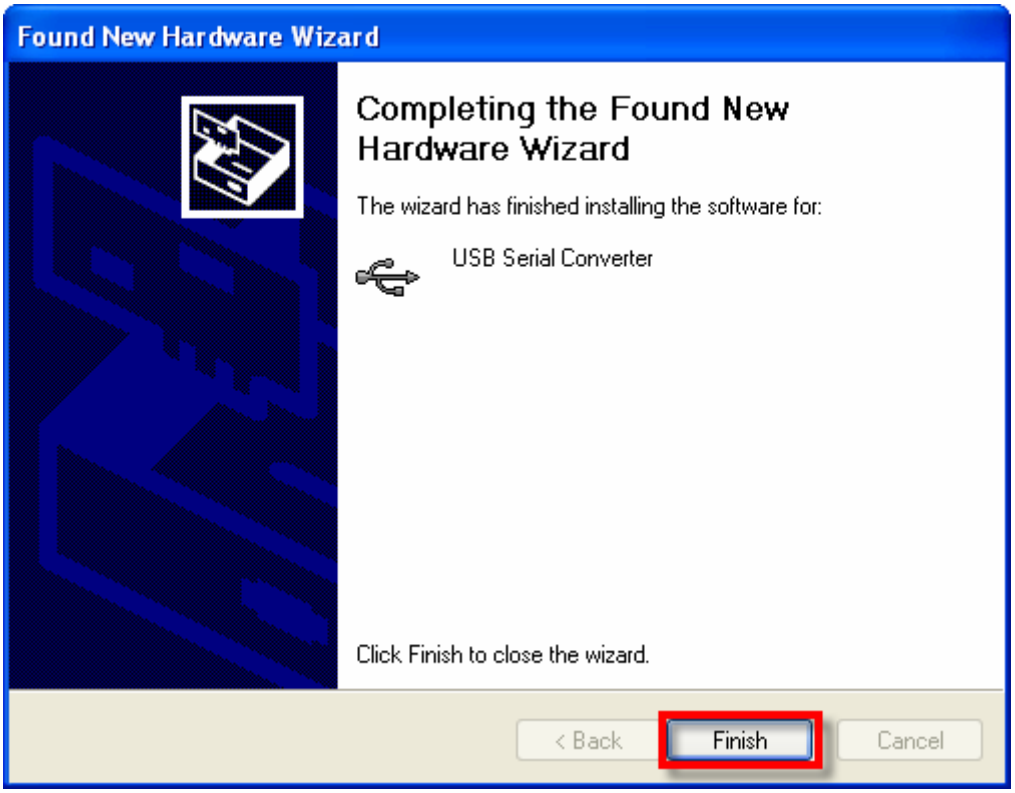
3. Choose **"Install from list or specific location (Advance)**" and then click **Next**; Windows will notify user to specify the location of folder that contains Driver of FTDI. Choose **Browse**, choose Drive and Folder that stores File Driver. If user has already installed program of Arduino completely, choose **"C:\arduino-0012\drivers\FTDI USB Drivers"** and then click **Next** as shown below;



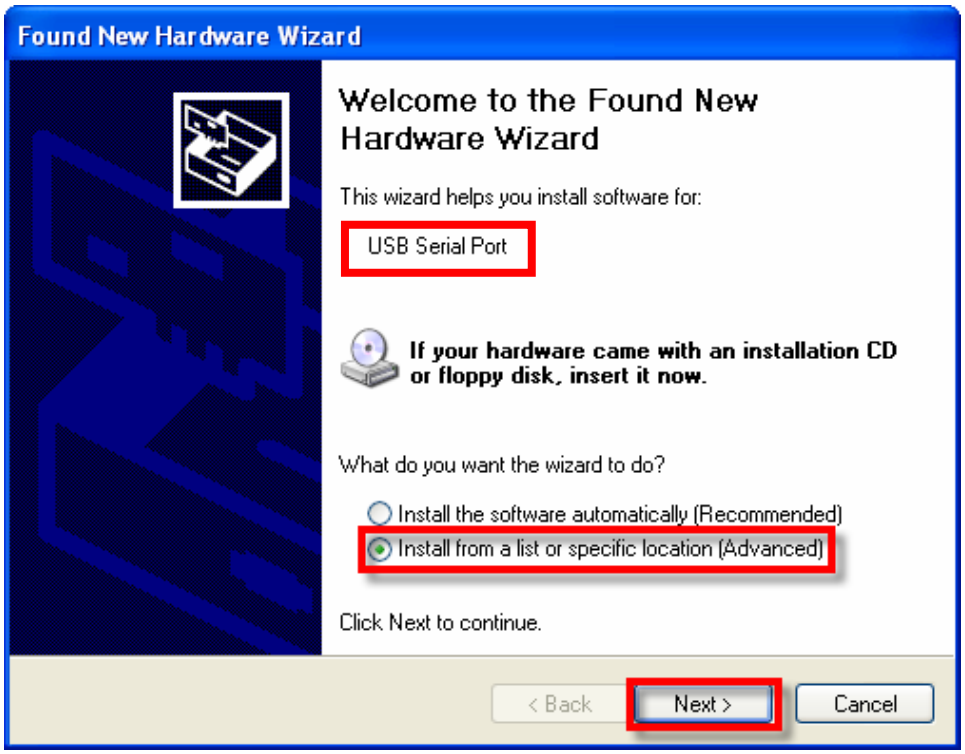

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\arduino-0012\drivers\FTDI USB Drivers
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

4. In this step, Program Windows will find and install Driver into device, please wait for a while until the operation is complete and than click Finish as shown below;





5. After installing Driver of hardware completely, Windows found that the new device that is **"USB Serial Port"** is connected and then it will notify user to install Driver into the new device that is specified as **"USB Serial Port"**. In this case, user specifies the location of folder that stores Driver as same as procedure in step 3 above as shown below;


Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB Serial Port
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

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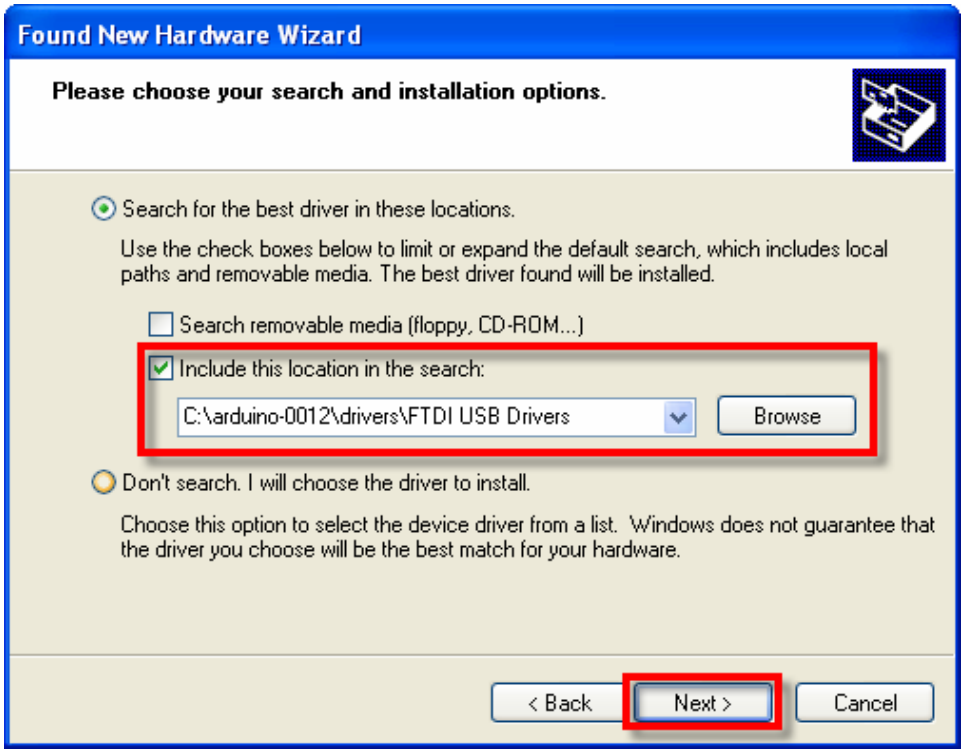
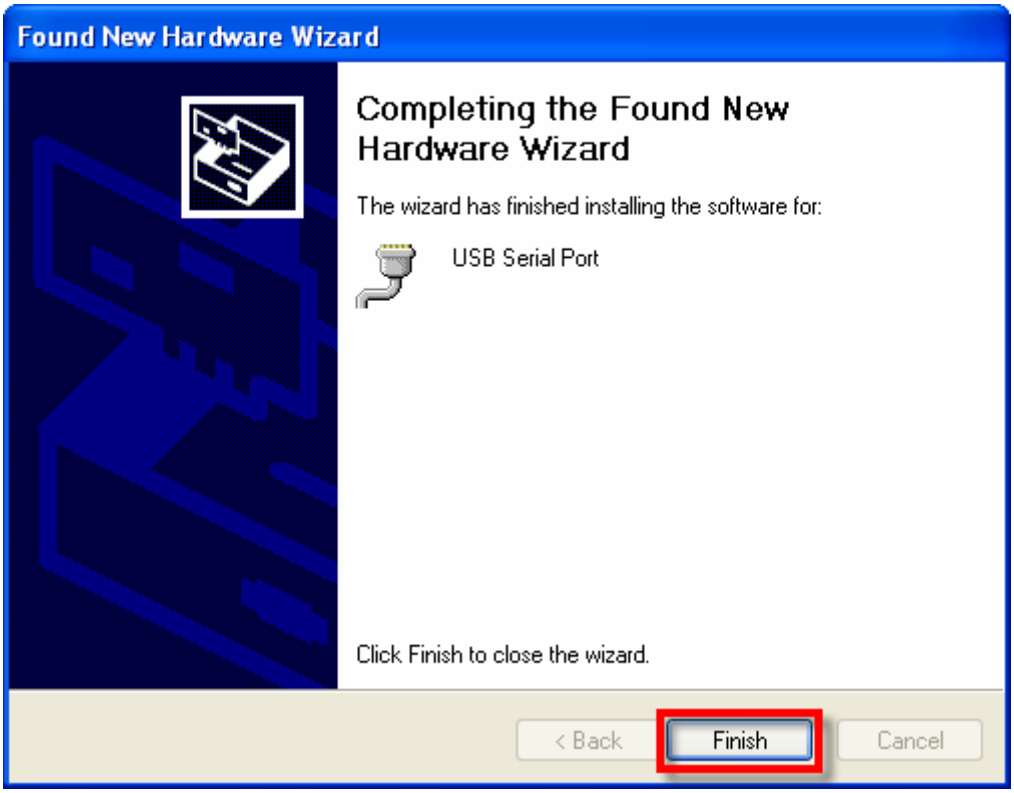
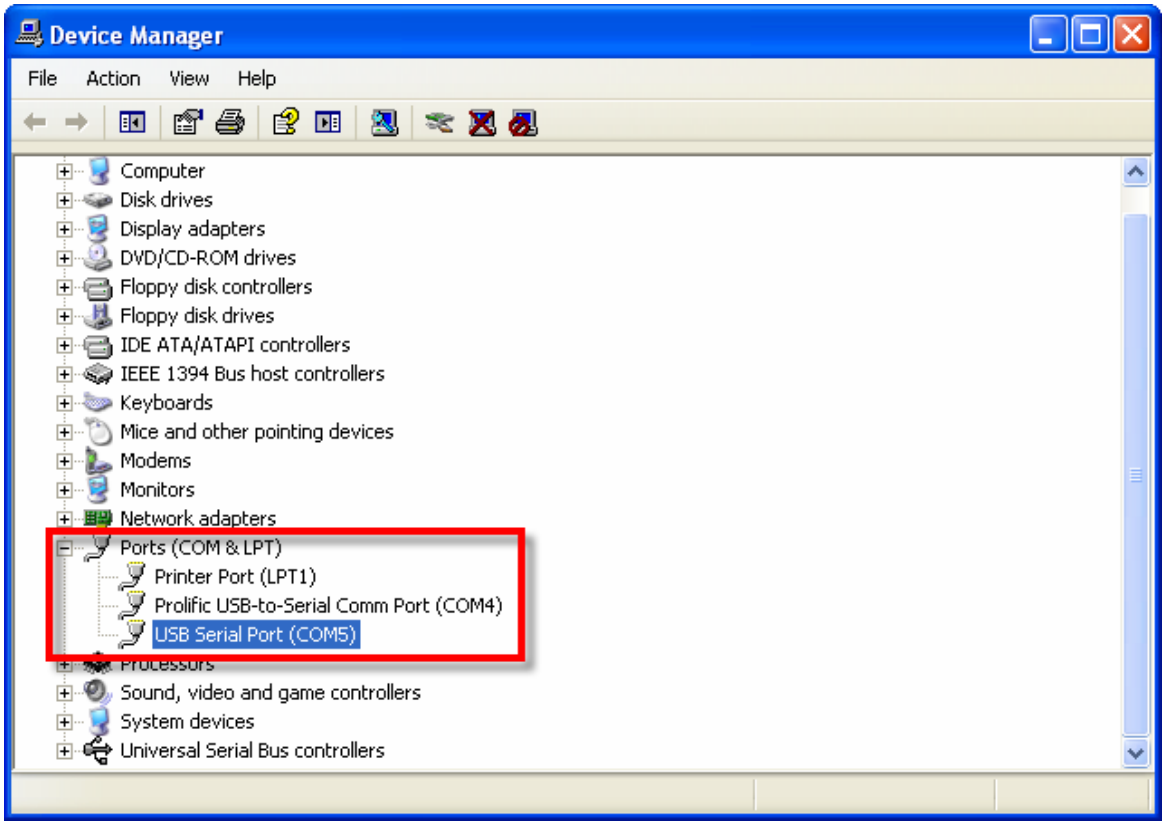

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\arduino-0012\drivers\FTDI USB Drivers
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

6. In this step, Program Windows will find and install Driver into the device, please wait for a while until the operation is complete and then click **Finish** as shown below;



7. After installing Driver completely, user can use the device instantly. However, user should check and adjust the values of the device first to make sure its accuracy. In this step, go to **"My Computer → Control Panel** (System (Hardware (Device Manager", check Port (COM&LPT) and then see the name of "USB Serial Port". User has to remember this Com Port number of the device because user needs to use it as reference when calling this function as shown below;

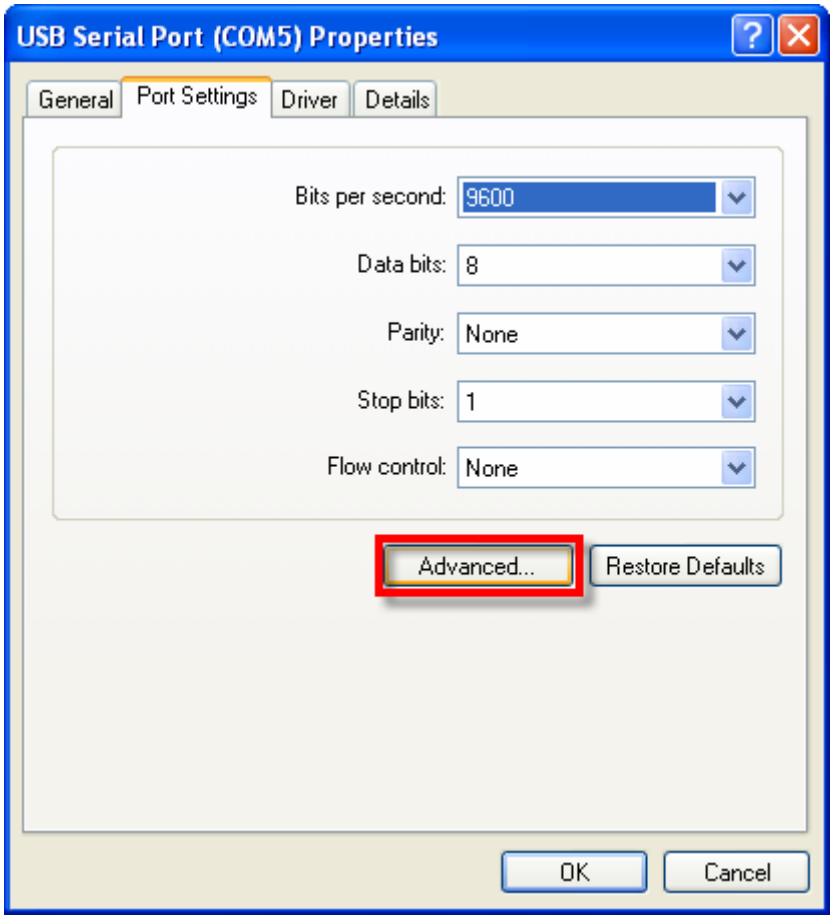


8. In this step, click sign **(+)** in front of **Ports (COM&LPT)** and then find the device **"USB Serial Port"** that has already been installed Driver. If user does not ensure that it is the device of Board **"ET-EASY168 STAMP"** or not, user has to remove USB Cable first and it makes all lists of device disappear; on the other hand, if user interfaces the USB Cable again, all lists of device must be appeared again. If everything is OK, click Tab that is list of device names, it will display window **"USB Serial Port Properties",** click **"Port Setting"** and then choose **Advance** to setup values into the device as follows;

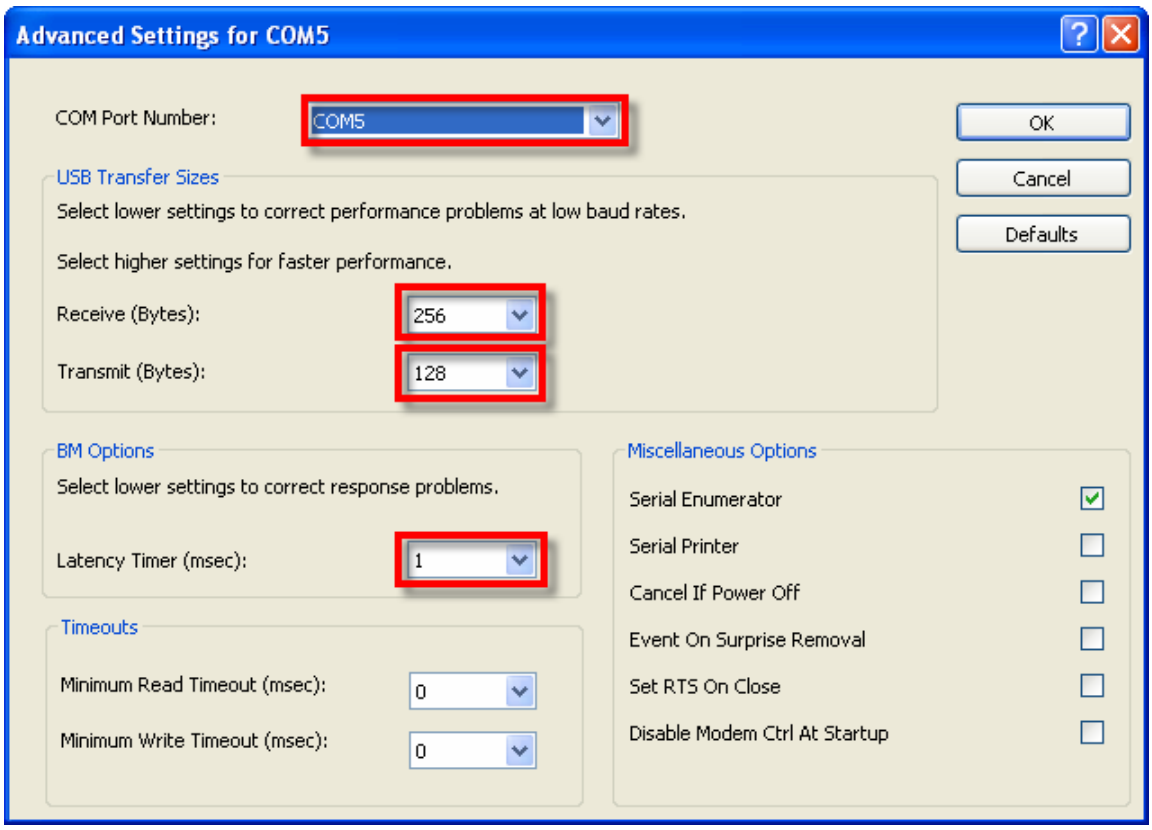
   a. USB Transfer Size (Receive (Bytes): Set it as 256.

   b. USB Transfer Size (Transmit (Bytes): Set it as 128.

   c. BM Option (Latency Timer (mSec): Set it as 1.


USB Serial Port (COM5) Properties
General
Port Settings
Driver
Details
Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None
Advanced...
Restore Defaults
OK
Cancel

↓


Advanced Settings for COM5
COM Port Number: COM5
OK
Cancel
Defaults
USB Transfer Sizes
Select lower settings to correct performance problems at low baud rates.
Select higher settings for faster performance.
Receive (Bytes): 256
Transmit (Bytes): 128
BM Options
Select lower settings to correct response problems.
Latency Timer (msec): 1
Timeouts
Minimum Read Timeout (msec): 0
Minimum Write Timeout (msec): 0
Miscellaneous Options
Serial Enumerator
Serial Printer
Cancel If Power Off
Event On Surprise Removal
Set RTS On Close
Disable Modem Ctrl At Startup

Development of ET-EASY168 STAMP in the format of Arduino Project

Normally, Board ET-EASY168 STAMP has already been installed Program Boot Loader completely. It uses Program Boot Loader named **"BOOT_EASY168_AUTO.HEX"** that is the original of Arduino and it is edited by ETT, especially the part of condition of application to be corresponding with the Hardware System of Board ET-EASY168 STAMP better. This Program Boot Loader is used to communicate and command to Upload Code from Computer PC into MCU on board without using external programmer. The specifications of Program Boot Loader that are additionally edited by ETT are described below;

- Communicate with external programmer through Protocol STK500 (STK500V1).
- Use Baud Rate 19200 with Frequency XTAL 16MHz.
- Size of Program Boot Loader is 2KByte and runs at position 0x3800-0x3FFF.
- Use LED that is connected with Pin Digital-13(PB5) to display status while Program Boot Loader is running.
- Program in Boot Loader always runs automatically after reset and MCU always starts running in this Boot Loader first. If there is no any communication from Program Arduino within 5 seconds, MCU will leave Boot Loader to start running in user's commands automatically. While Boot Loader is running, LED that is connected with Pin Digital-13(PB5) will blink 3 times first and then ON to wait for the command from program to Upload Code into MCU. If there is no any communication from Program of Arduino within 5 seconds, program will skip over to run in the beginning position in the part of the program that is written by user instantly.

Moreover, user can use the other standard Program Boot Loader according to program of Arduino. In this case, it uses Program Boot Loader called **"ATmegaBOOT_168_diecimila.hex"** that is contained in the same Drive and Folder that user has already installed program of Arduino that is **"C:\arduino-0012\hardware\bootloaders\atmega168\ATmegaBOOT_168_diecimila.hex"**.

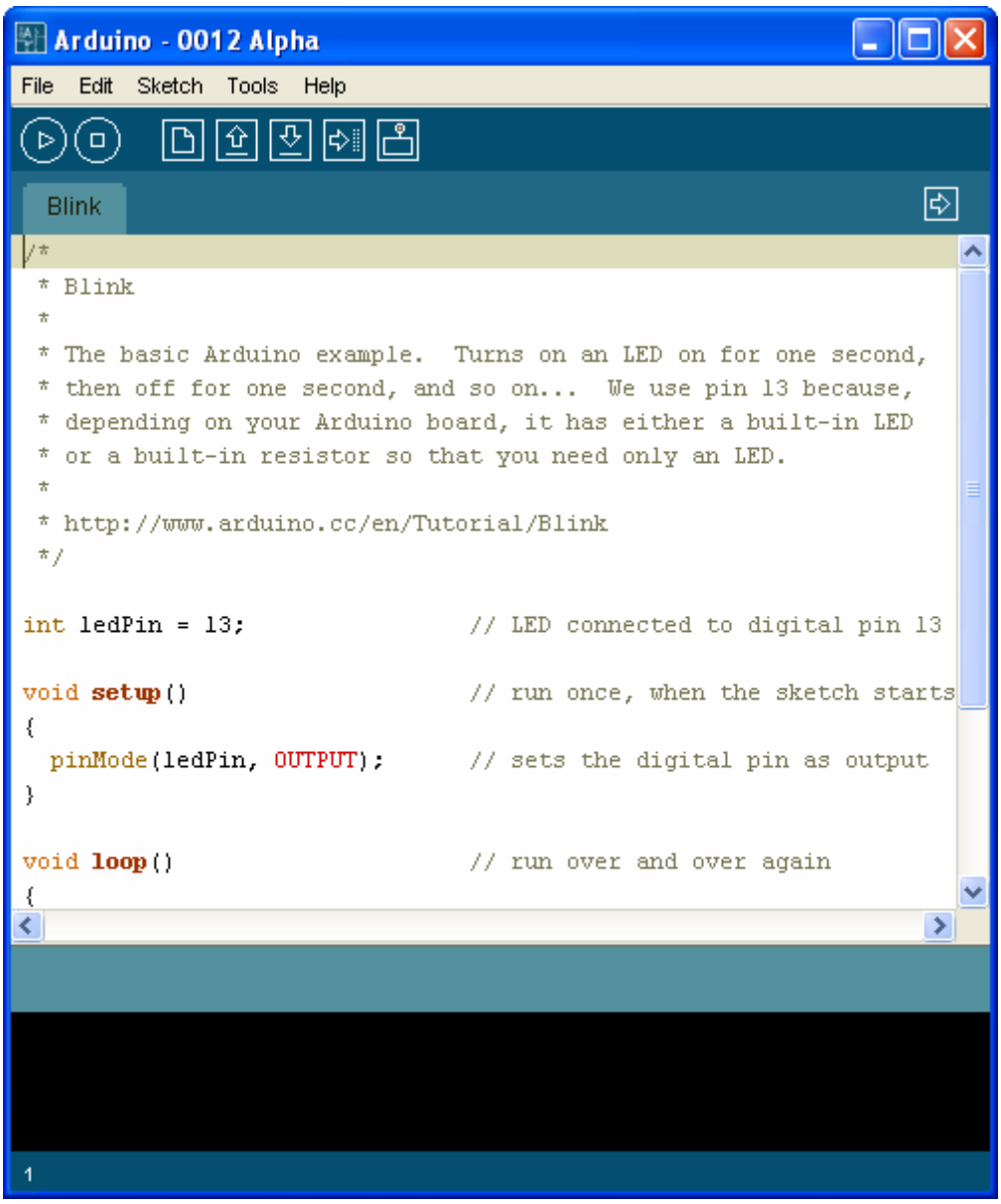
However, it is necessary to have device that can program Code into MCU if user wants to install Program Boot Loader Code into MCU. In this case, user can use Programmer that has the Connector IDE 10 PIN standard "AVRISP" of ATMEL instantly. Please see more information from **"How to Program Boot Loader into Board ET-EASY168 STAMP"** at the end of this User's Manual.

How to install Program Arduino

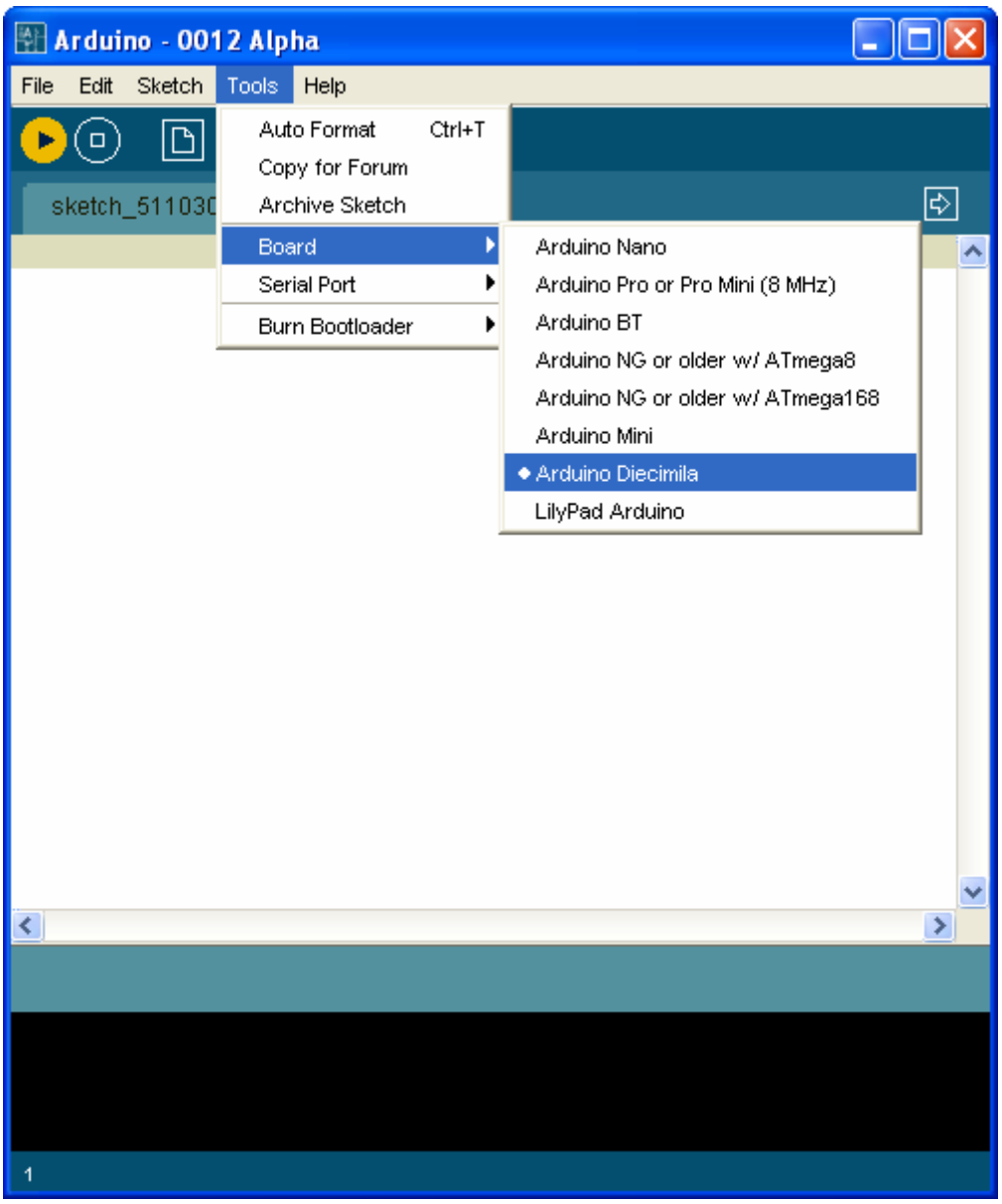
After installing USB Driver into board completely, it ends the procedure of preparation. Next, it is the procedure of applying, writing and learning program as desired. First of all, user has to install Program of Arduino to be learning program as procedures below;

1. Unzip File name **"arduino-0012-win.zip**" in Hard disk; in this case, we recommend user to unzip that file in outermost Root of Drive C. After unzipping completely, the program is in **"c:\arduino-0012".**

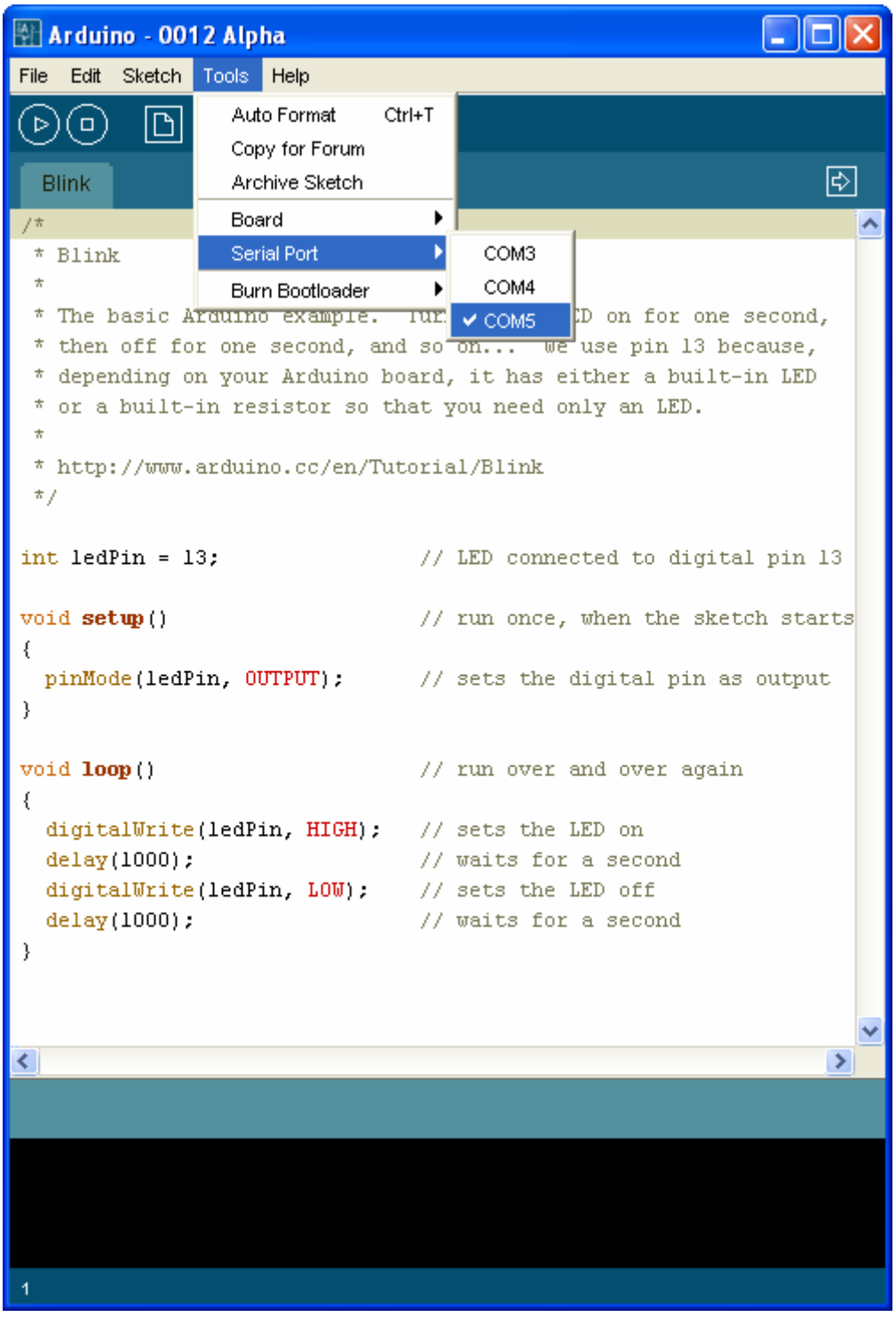
2. Run Program "arduino.exe" and it will display result as shown below;


Arduino - 0012 Alpha
File Edit Sketch Tools Help
Blink
/*
* Blink
*
* The basic Arduino example. Turns on an LED on for one second,
* then off for one second, and so on... We use pin 13 because,
* depending on your Arduino board, it has either a built-in LED
* or a built-in resistor so that you need only an LED.
*
* http://www.arduino.cc/en/Tutorial/Blink
*/
int ledPin = 13; // LED connected to digital pin 13
void setup() // run once, when the sketch starts
{
pinMode(ledPin, OUTPUT); // sets the digital pin as output
}
void loop() // run over and over again
{
1

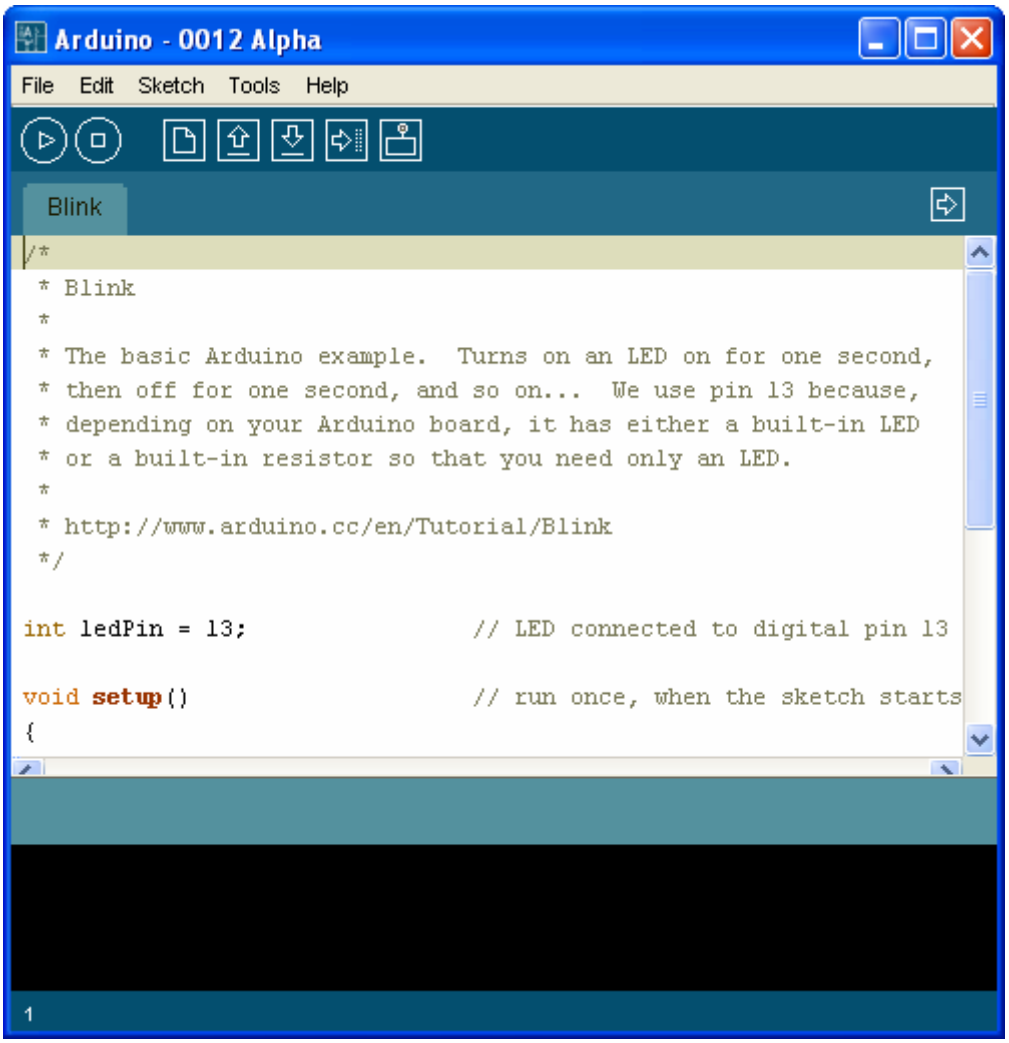
3. If using this program in the first time, user needs to setup Hardware System that is used with program of Arduino first because nowadays there are many hardware versions that are designed and created to use with Program Development of Arduino. In the case of Board ET-EASY168 STAMP, please set name of board as "**Diecimila**" and click Menu **"Tools → Board → Arduino Diecimila";** and then it will display result as shown below;



4. Set Com Port Number to communicate with board that must be corresponding with Com Port Number that has already been installed Driver of USB previously. For example, if installing Driver of USB and its Com Port Number is COM5, click Menu **"Tools → Serial Port → COM5**" as shown below;

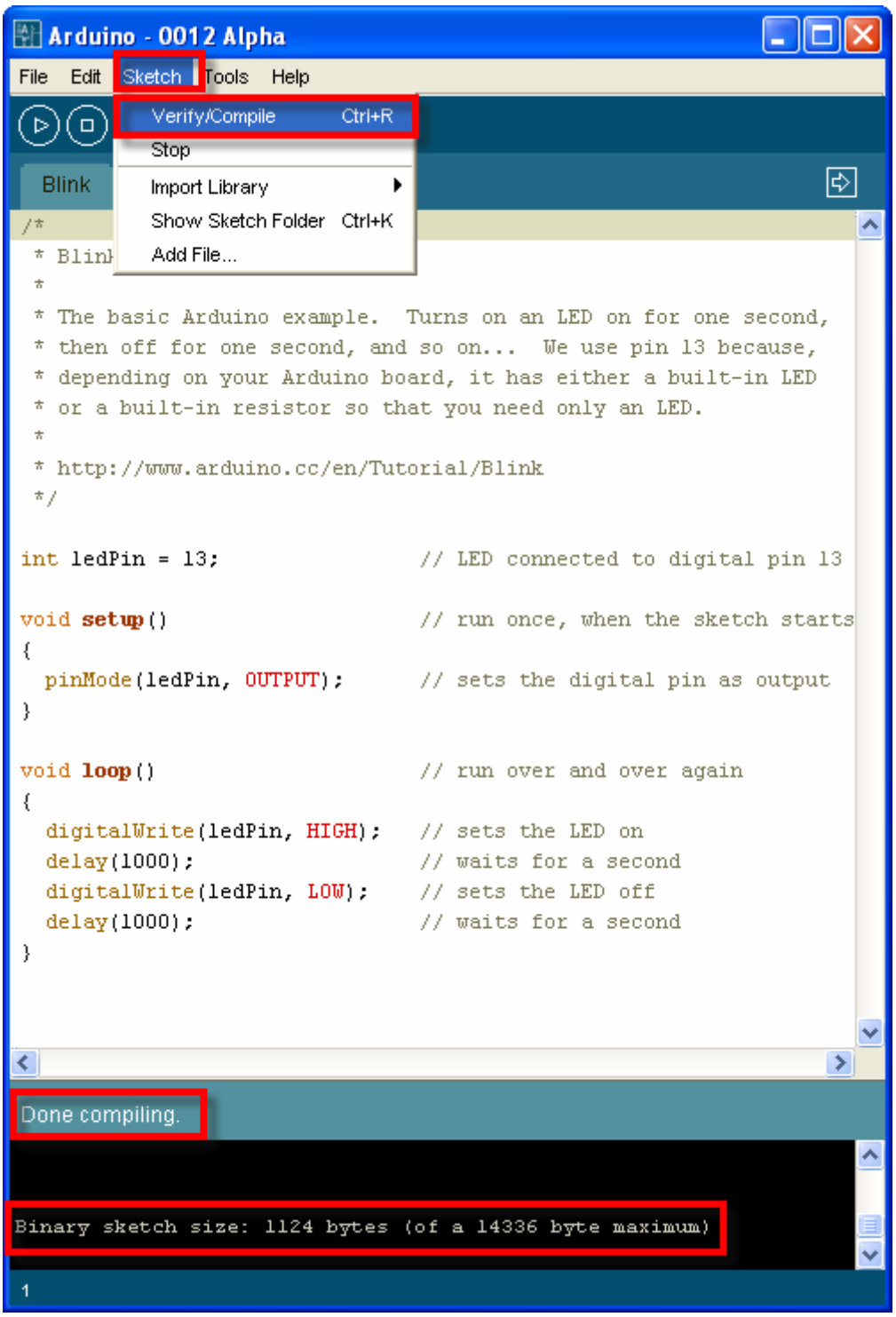

Arduino - 0012 Alpha
File Edit Sketch Tools Help
Auto Format Ctrl+T
Copy for Forum
Archive Sketch
Board
Serial Port
Burn Bootloader
COM3
COM4
COM5
Blink
/*
* Blink
*
* The basic Arduino example. Turns on for one second,
* then off for one second, and so on... We use pin 13 because,
* depending on your Arduino board, it has either a built-in LED
* or a built-in resistor so that you need only an LED.
*
* http://www.arduino.cc/en/Tutorial/Blink
*/
int ledPin = 13; // LED connected to digital pin 13
void setup() // run once, when the sketch starts
{
pinMode(ledPin, OUTPUT); // sets the digital pin as output
}
void loop() // run over and over again
{
digitalWrite(ledPin, HIGH); // sets the LED on
delay(1000); // waits for a second
digitalWrite(ledPin, LOW); // sets the LED off
delay(1000); // waits for a second
}
1

5. Test on writing program, click Menu **"File → New"** and type program to test or maybe open the created example file instead. In this case, we recommend user to test program of blinking light, click Menu **"File →** sketchbook (Examples (Digital (Blink" and it will display result as shown below;

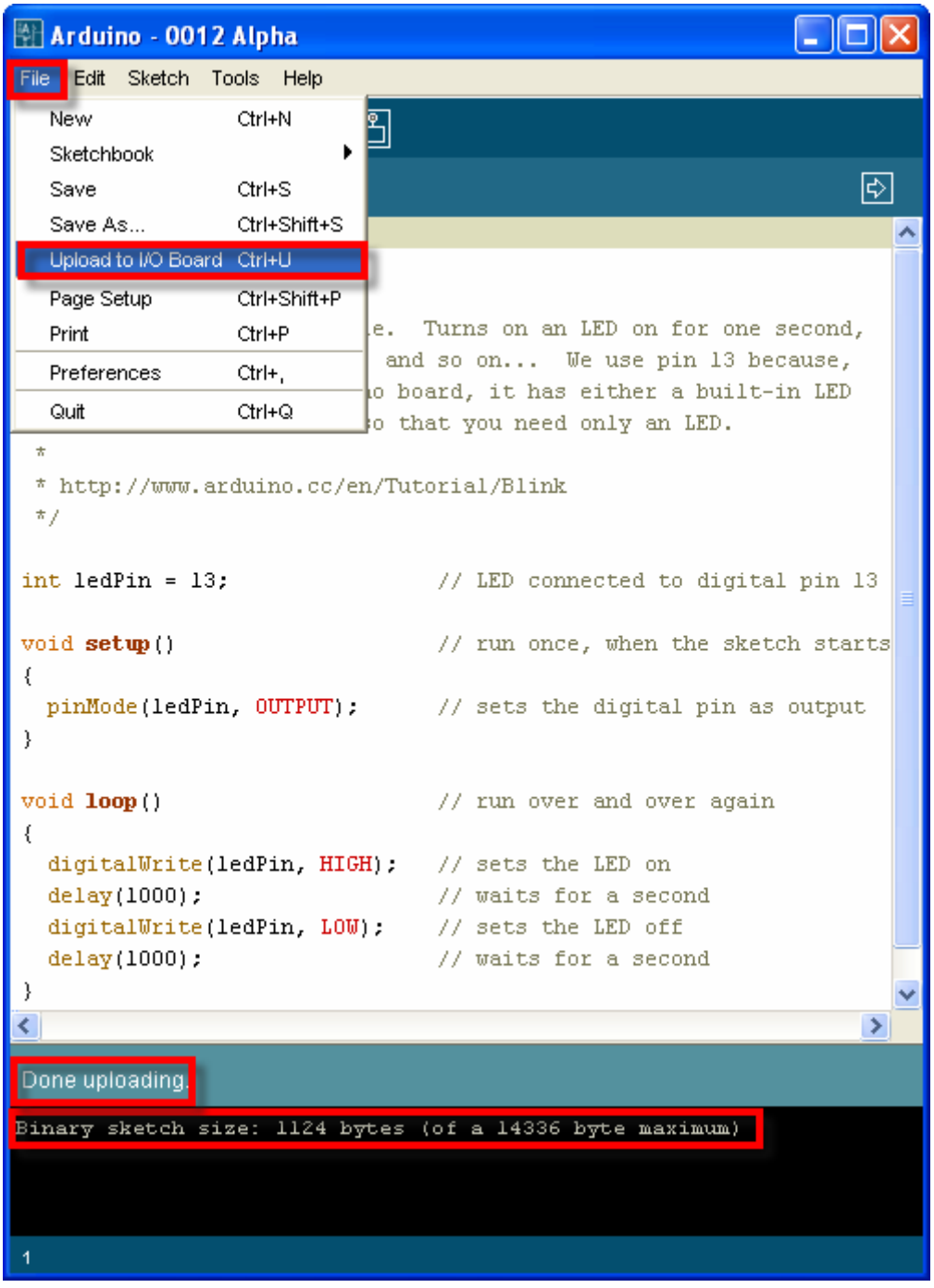

Arduino - 0012 Alpha
File Edit Sketch Tools Help
Blink
/*
* Blink
*
* The basic Arduino example. Turns on an LED on for one second,
* then off for one second, and so on... We use pin 13 because,
* depending on your Arduino board, it has either a built-in LED
* or a built-in resistor so that you need only an LED.
*
* http://www.arduino.cc/en/Tutorial/Blink
*/
int ledPin = 13; // LED connected to digital pin 13
void setup() // run once, when the sketch starts
{
1

```
int ledPin = 13;

void setup()
{
  pinMode(ledPin, OUTPUT);
}

void loop()
{
  digitalWrite(ledPin, HIGH);
  delay(1000);
  digitalWrite(ledPin, LOW);
  delay(1000);
}
```

6. Compile program, click Menu "**Sketch → Verify/Compile"** as shown in the example below;


Arduino - 0012 Alpha
File Edit Sketch Tools Help
Verify/Compile Ctrl+R
Stop
Import Library
Show Sketch Folder Ctrl+K
Add File...
Blink
/*
* Blink
*
* The basic Arduino example. Turns on an LED on for one second,
* then off for one second, and so on... We use pin 13 because,
* depending on your Arduino board, it has either a built-in LED
* or a built-in resistor so that you need only an LED.
*
* http://www.arduino.cc/en/Tutorial/Blink
*/
int ledPin = 13; // LED connected to digital pin 13
void setup() // run once, when the sketch starts
{
pinMode(ledPin, OUTPUT); // sets the digital pin as output
}
void loop() // run over and over again
{
digitalWrite(ledPin, HIGH); // sets the LED on
delay(1000); // waits for a second
digitalWrite(ledPin, LOW); // sets the LED off
delay(1000); // waits for a second
}
Done compiling.
Binary sketch size: 1124 bytes (of a 14336 byte maximum)
1

7. Download Code into board, click Menu **"File → Upload to I/O Board"**, wait for a while until the operation is complete and it should display result as shown below;

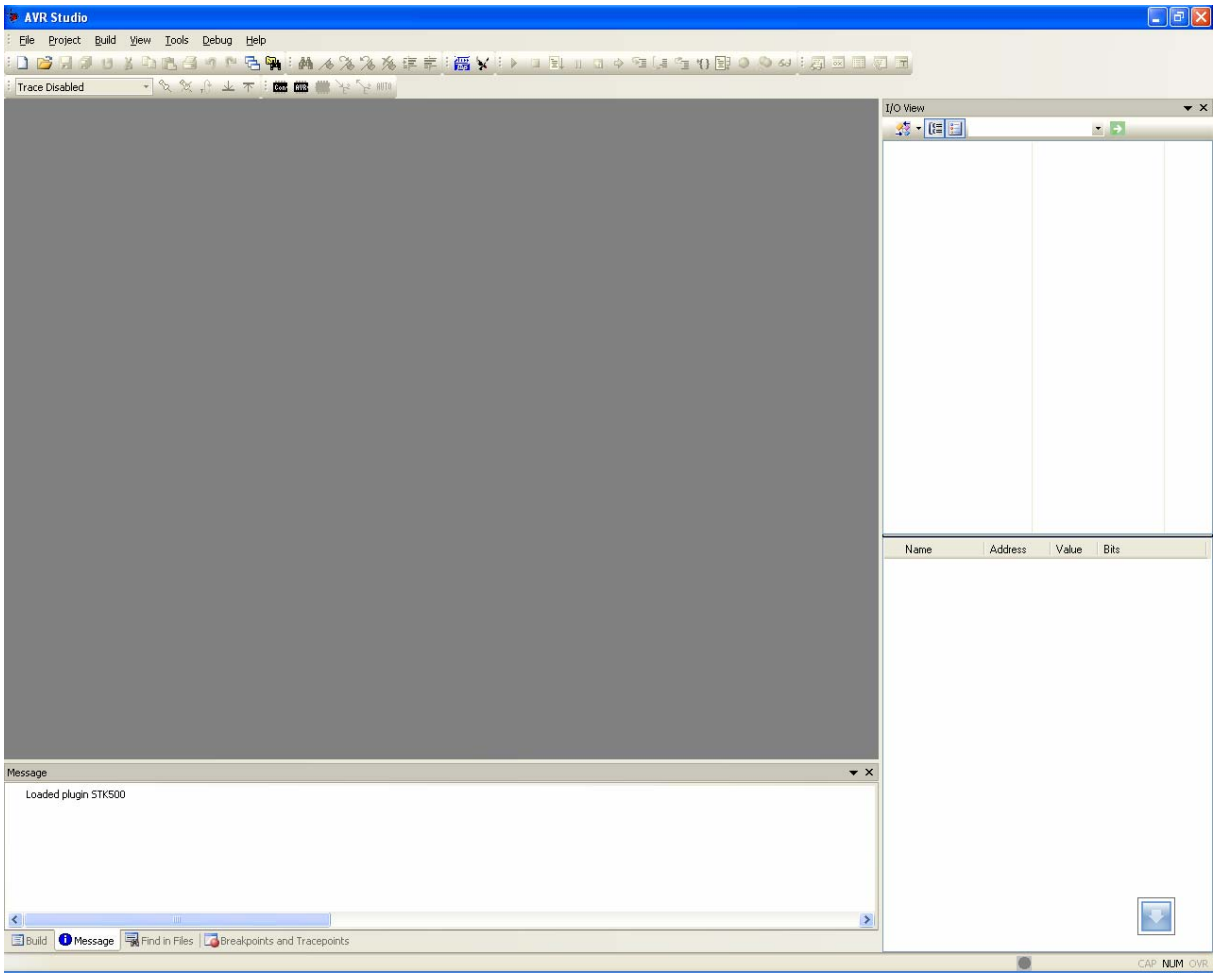

Arduino - 0012 Alpha
File Edit Sketch Tools Help
New Ctrl+N
Sketchbook
Save Ctrl+S
Save As... Ctrl+Shift+S
Upload to I/O Board Ctrl+U
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+,
Quit Ctrl+Q
e. Turns on an LED on for one second,
and so on... We use pin 13 because,
o board, it has either a built-in LED
o that you need only an LED.
*
* http://www.arduino.cc/en/Tutorial/Blink
*/
int ledPin = 13; // LED connected to digital pin 13
void setup() // run once, when the sketch starts
{
pinMode(ledPin, OUTPUT); // sets the digital pin as output
}
void loop() // run over and over again
{
digitalWrite(ledPin, HIGH); // sets the LED on
delay(1000); // waits for a second
digitalWrite(ledPin, LOW); // sets the LED off
delay(1000); // waits for a second
}
Done uploading.
Binary sketch size: 1124 bytes (of a 14336 byte maximum)
1

8. After Upload Code into board completely, board starts running follow the written commands in program instantly. User can see blinking of LED that alternates between ON and OFF at the speed of 1 second all the time.

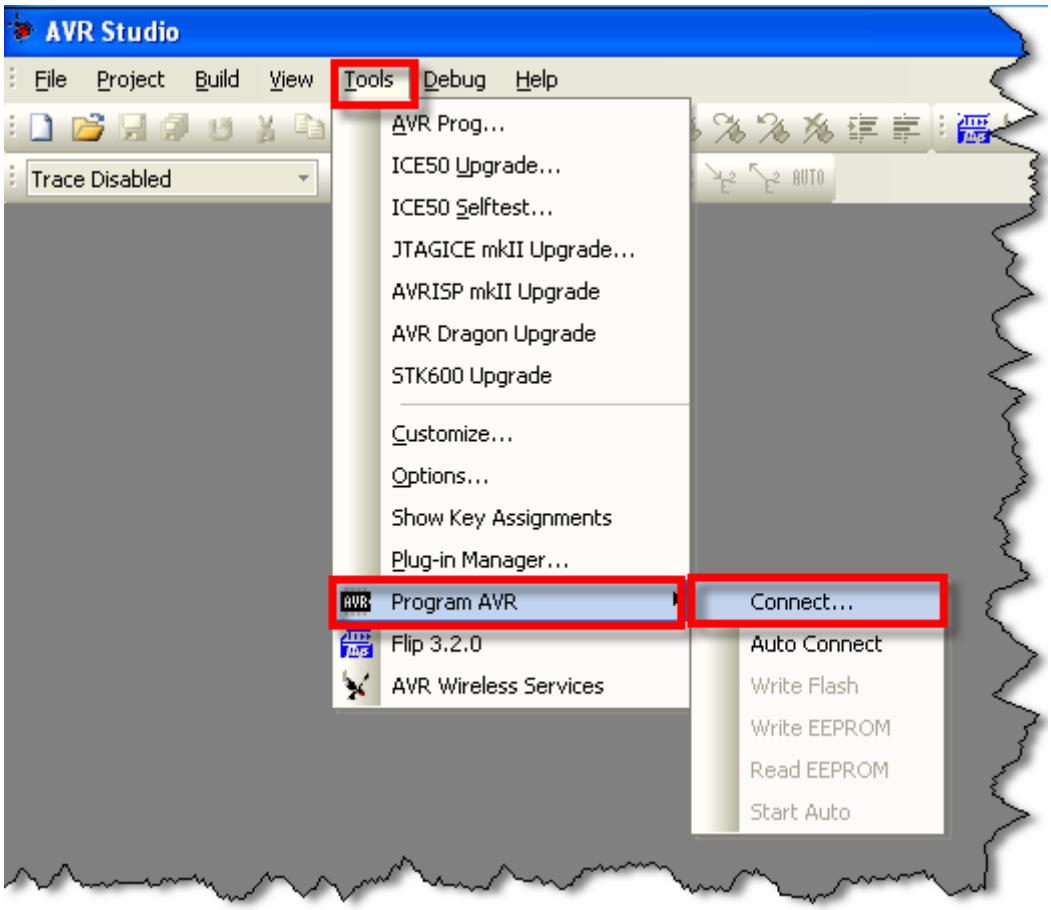
How to Program Boot Loader into Board ET-EASY168 STAMP

Normally, Board ET-EASY168 STAMP has already been programmed Boot Loader completely, so user can use it instantly. However, if user wants to change the new Boot Loader or there is mistake and makes Boot Loader damaged, user can program new Boot Loader into board. Board ET-EASY168 STAMP is designed to have AVRISP Connector to program Code into MCU directly, so it can be connected with all programmer versions that have connector corresponding with AVRISP standard of ATMEL instantly. In this case, we will represent how to program Boot Loader with programmer of ETT Version **"ET-AVR ISP USB V1.0"** and use Program **"AVR Studio 4"** of ATMEL as described below;

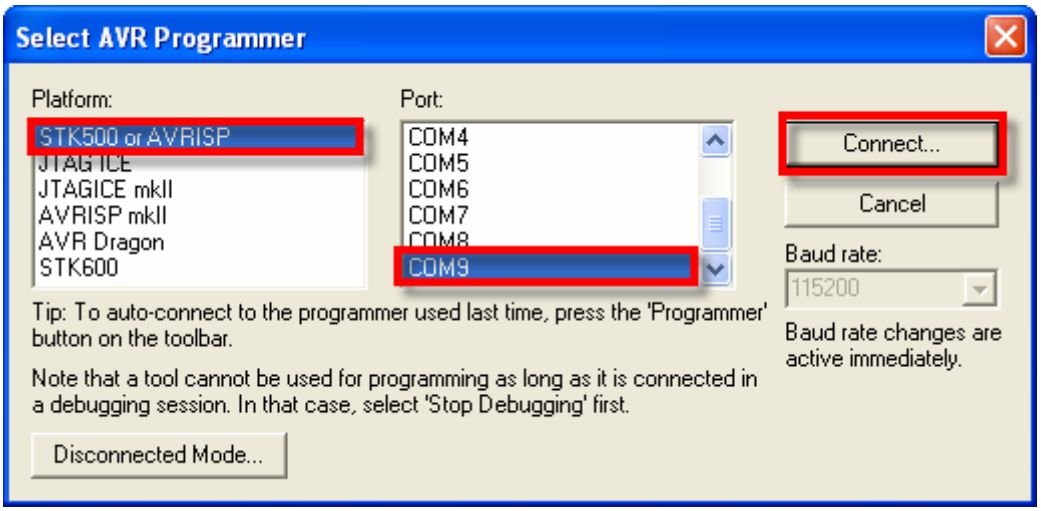
1. Interface USB Cable with Board ET-EASY168 STAMP if user wants to use Power Supply from Port USB or supply +5V Power Supply into board at Pin 28(+5V).
2. Interface USB Cable with Programmer "**ET-AVR ISB USB V1"** and interface 10Pin Pair Cable between AVRISP Connector of both boards together.
3. Run Program **AVR Studio 4** and it will display result as shown below;



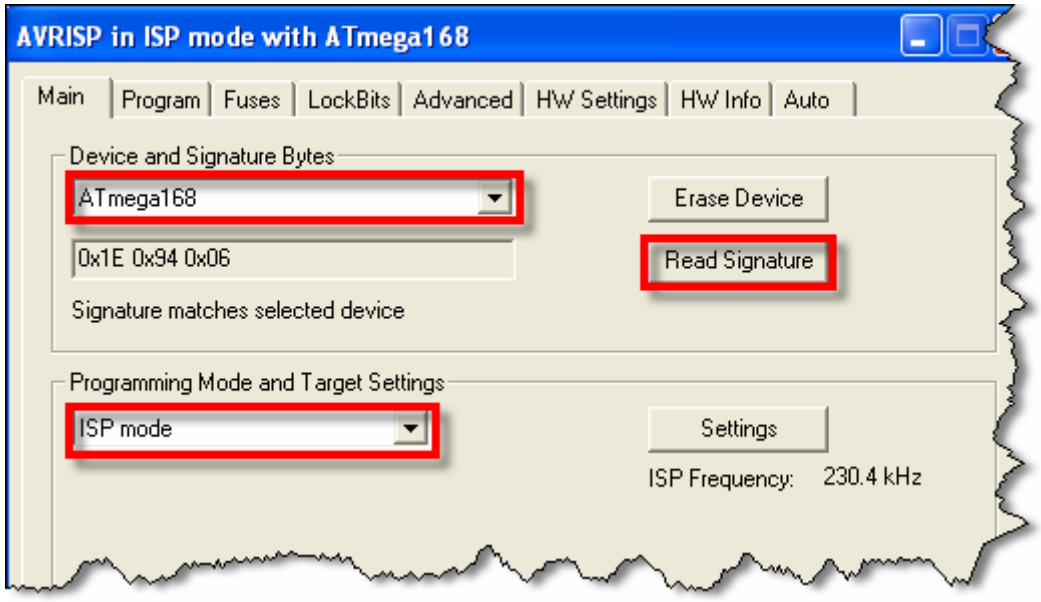
4. Click Menu **"Tools → Program AVR → Connect.. → STK500 or AVRISP"**, choose Com Port Number of Programmer ET-AVR ISP USB V1 corresponding with the Driver that has already been installed previously, and then choose **Connect** (in the example is Com9)as shown below;



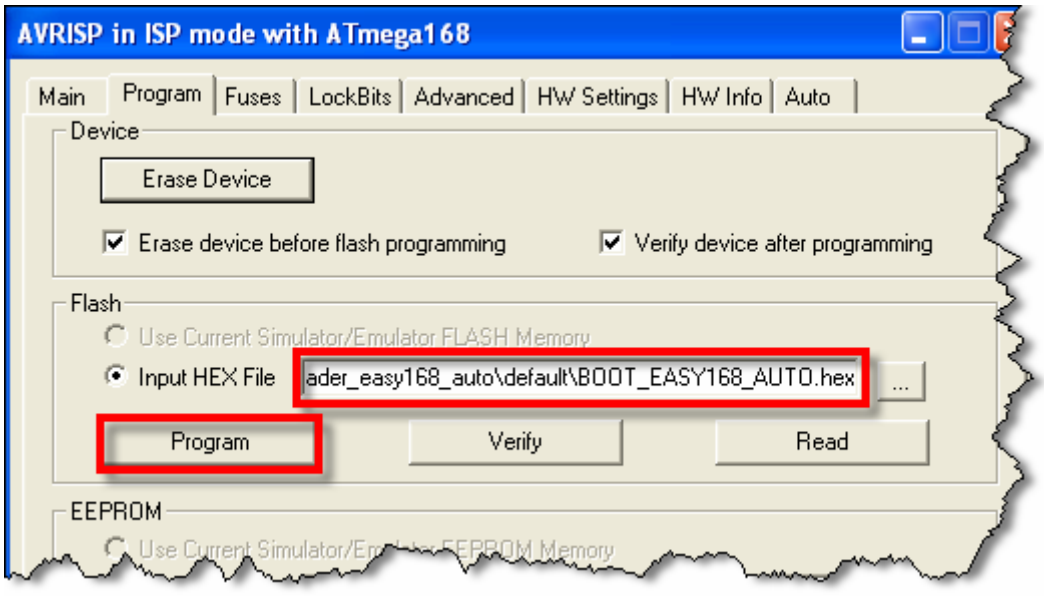
↓



5. After connected completely, user should test on the connection. Click **Tab Main**; choose the MCU number to be **ATmega168**; choose **Programming Mode and target Settings** to be **ISP Mode** and then choose Read Signature. If everything is OK, it will display results as shown below;

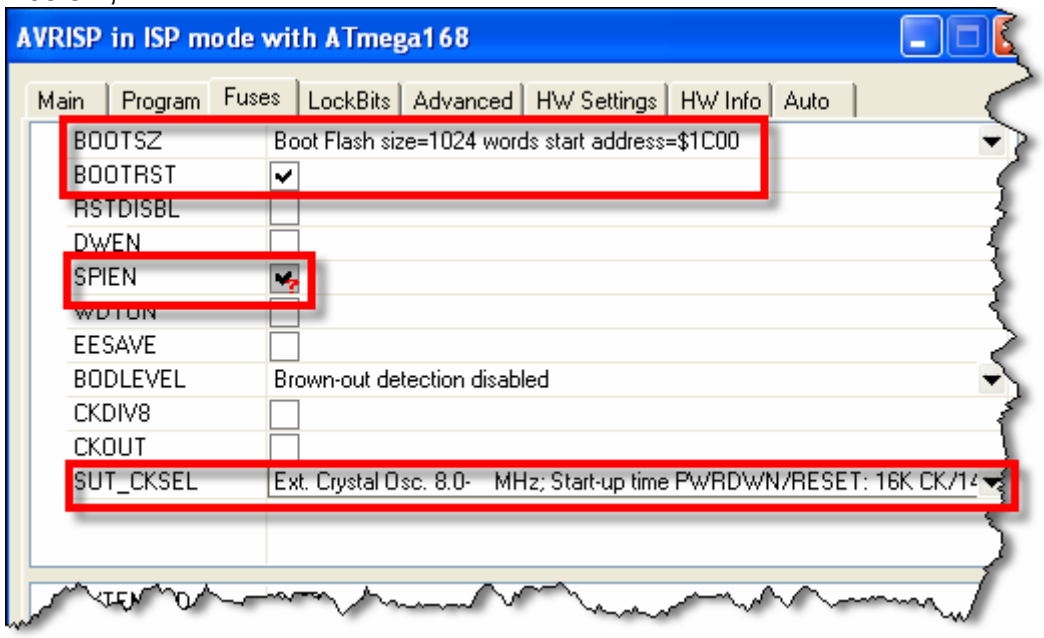


6. Choose **Tab Program** and then choose options as follows;
   - **Device**: Choose **Erase device before flash programming** and **Verify device after programming**.
   - **Flash**: Choose **Input HEX File** to be **"BOOT_EASY168_AUTO.HEX"** and then choose **Program** to program Boot Loader into MCU and it will display result as shown below;

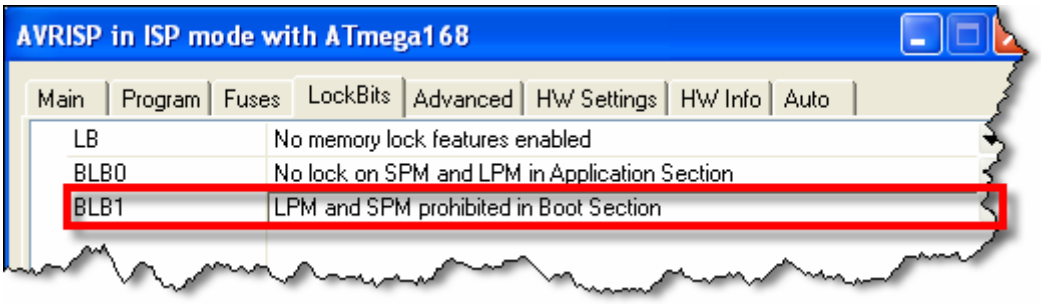


7. After programmed Code into MCU completely, choose **Tab Fuses** to program Fuse Bit into MCU and then set options as follows;
   - Set **BOOTSZ** to be **Boot Flash size = 1024 word start address = $1C00.**
   - Set **BOOTRST** to be **Enable**.
   - Set **SPIEN** to be **Enable**.
   - Set **SUT_CKSEL** to be **Ext.Crystal Osc 8.0MHz; Start-up time PWRDN/RESET: 16K CK/14** that is the option at the end.

When user has already chosen all options completely, it will display result as shown below;



8. After programmed Fuse Bit completely, choose **Tab LockBits**. In this case, set Protect for particular Boot Loader only; choose **BLB1** to be **LPM and SPM prohibited in Boot Section** and then **Program**. It ends the procedure of program Boot Loader.

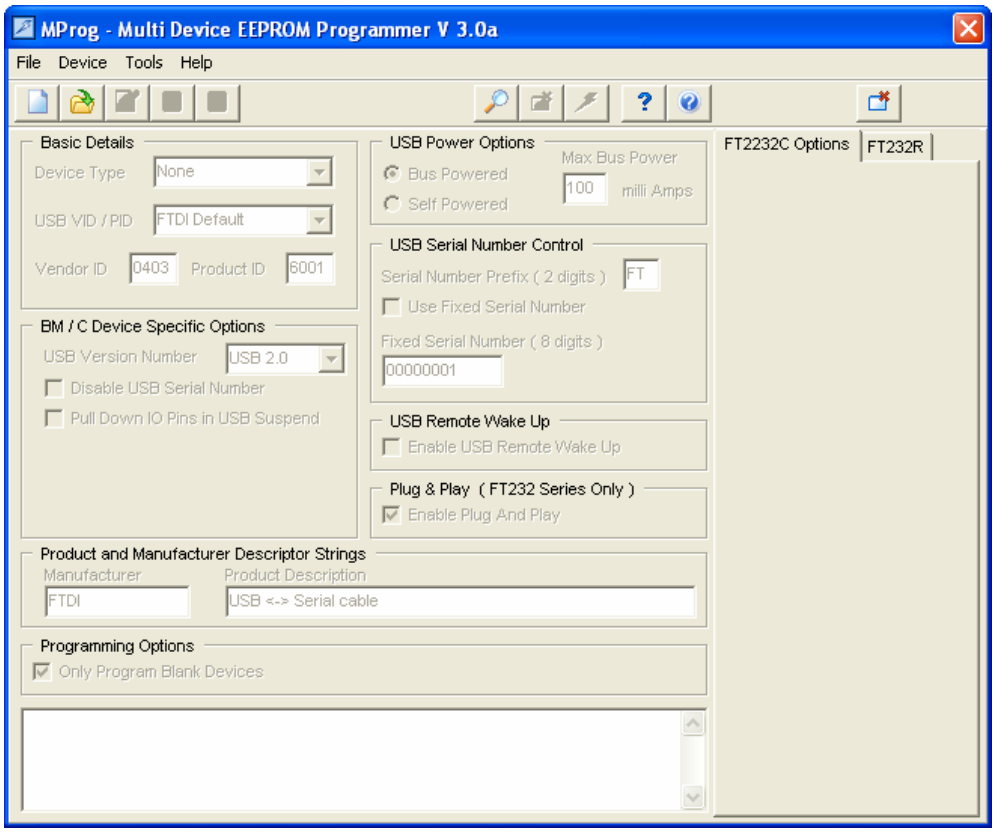


How to Program USB Bridge of FTDI into Port USB for supplying 500mA

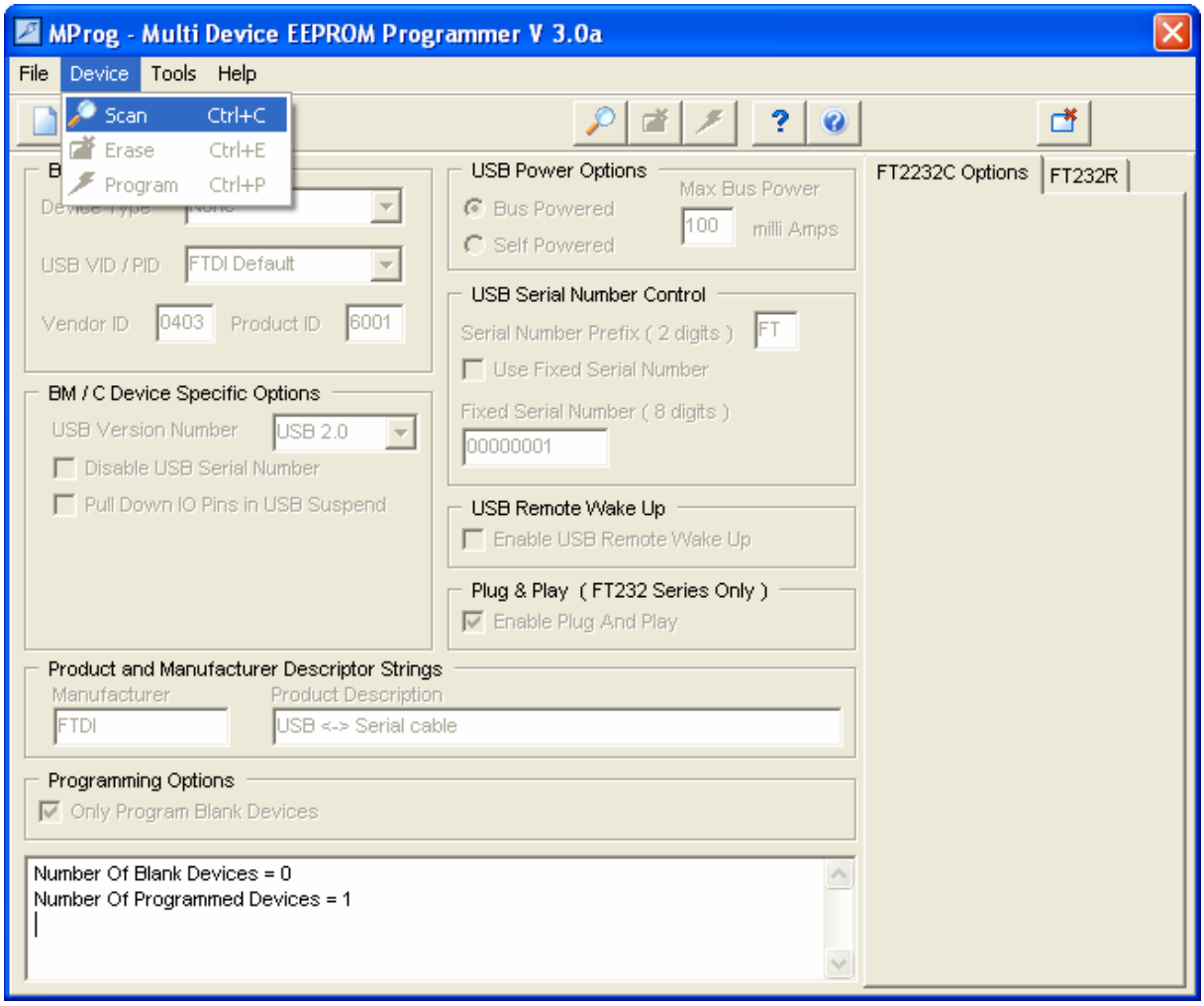
Normally, the Configuration value of USB Bridge No.FT232R from FTDI will be set to use with Power Supply from Port USB. The standard value of USB Driver of FTDI requests only 90mA current from USB Host but the standard value of Port USB can supply power to the connective devices up to 500mA. If using Board ET-EASY168 STAMP to test and it connects with less external device (use current not higher than 500mA), user can modify Configuration value of USB HUB to supply 500mA current because it makes the experiment more convenient. However, if using Notebook Computer that uses current from battery to test or connect Test Board with device that uses very high current, it is better if user provides external Power Supply to support board by self. This recommendation is suitable for user who wants to test operation or to test on writing program with board and the board connects with less external device; for example, it tests on blinking by using LED or transmit-receive data with Serial Port Communication.

The method to modify or edit Configuration value of USB Bridge from FTDI is to use Program **"MProg.exe"** as described below;

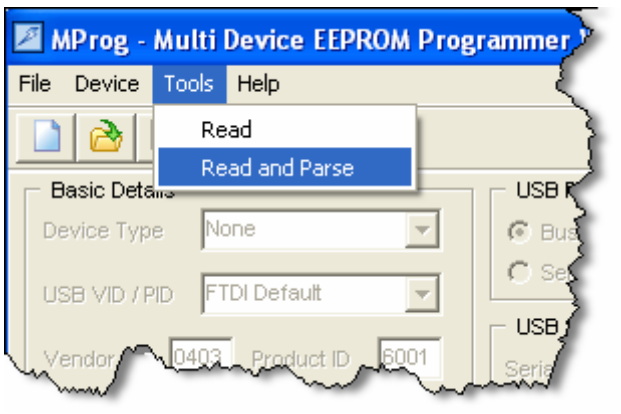
1. Interface USB Cable of Board ET-EASY168 STAMP with Port USB and then run Program MProg. It will display results as follows;

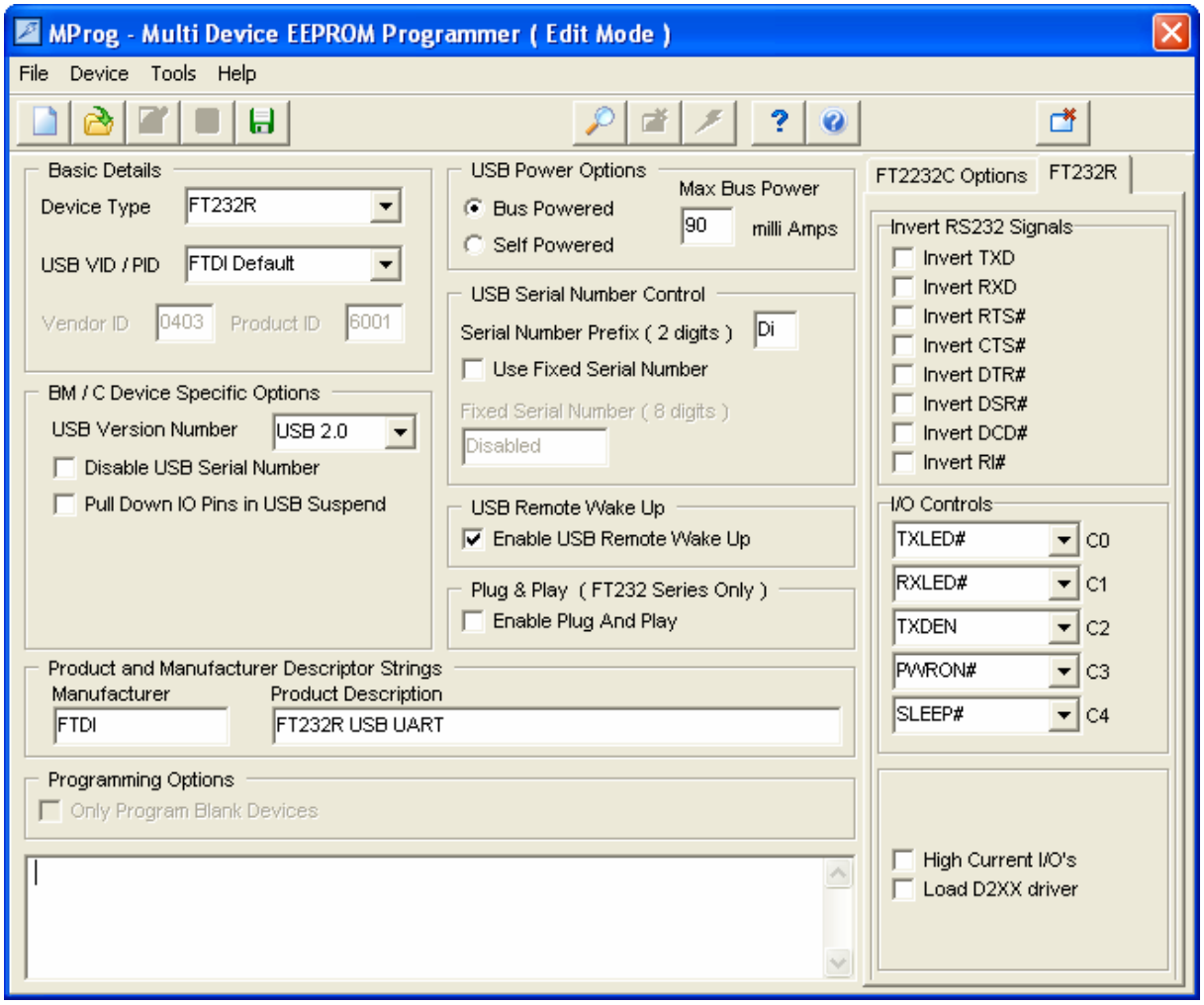


2. Command Program "**mProg**" to find out USB Bridge that has already been installed, click Menu "**Device → Scan"** and it should display result as shown below;

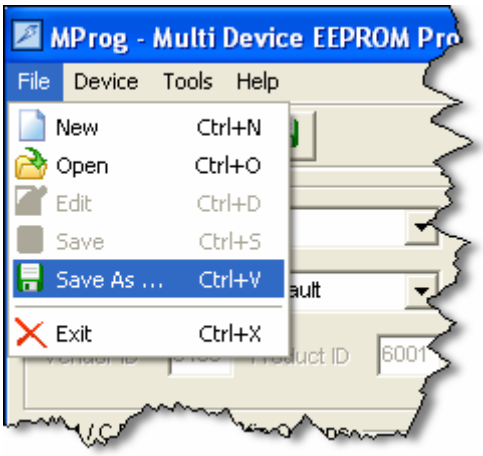


3. Read the old Configuration values of FTDI, click Menu "**Tools → Read and parse**" and it should display result as shown below;

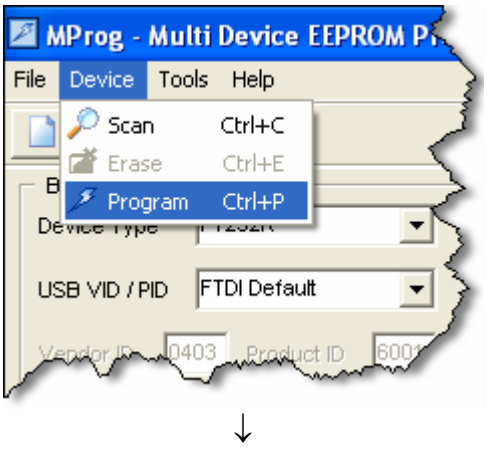


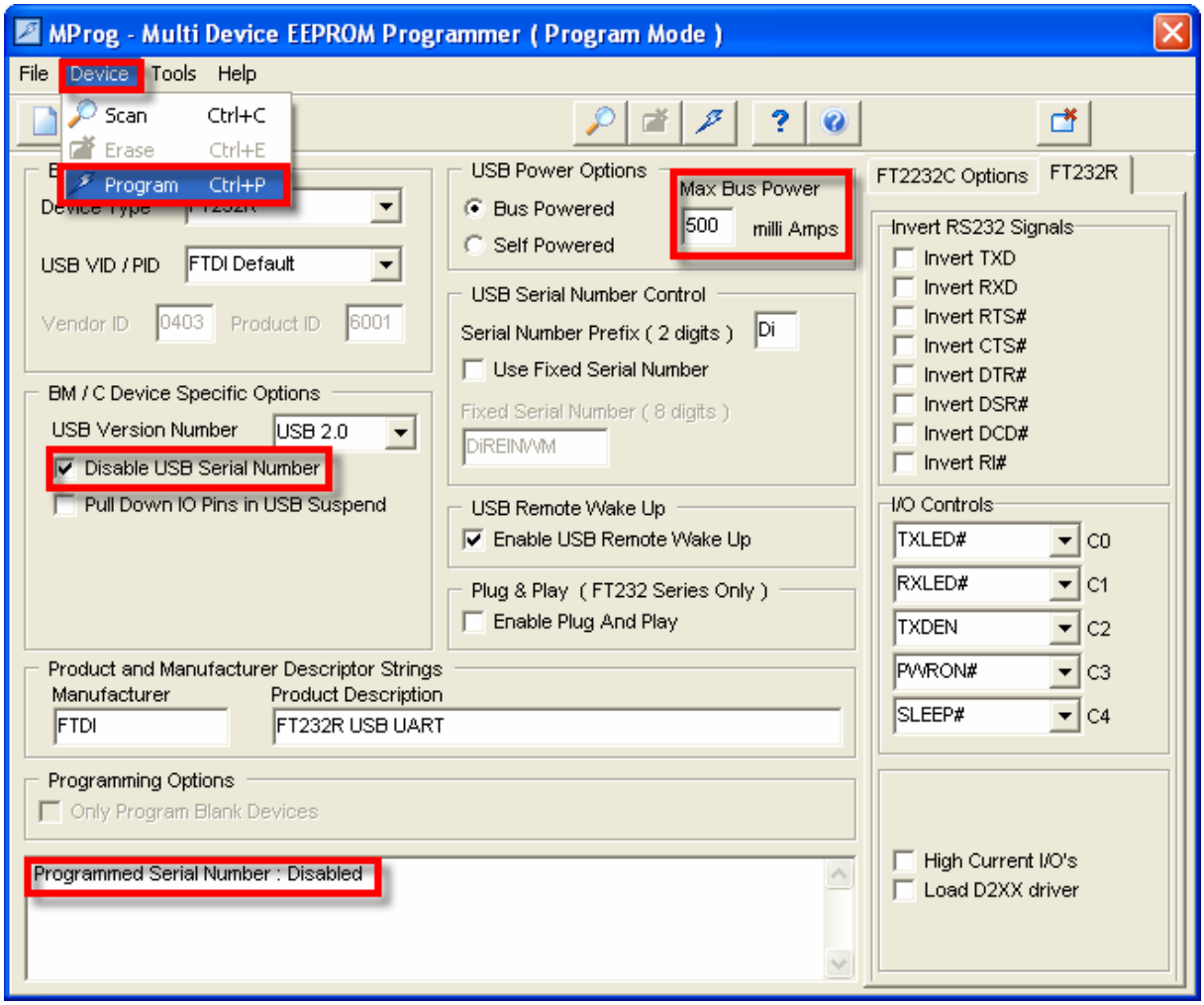


4. Modify or edit the Configuration values; set **USB Power Options** to be **Bus Powered** and set **Max Bus Power** from **90 milli Amps** to **500 milli Amps**. For other Configuration values, it should not be changed and then save the new Configuration values, click Menu "**File → Save As..**" as shown below;



5. Program and return Configuration values to FTDI; click Menu **"Device → Program"** and then wait for until the operation is complete. Next, remove USB Cable and then interface it again, it makes USB run with the new Configuration.





Development of d ET-EASY168 STAMP in format of AVR Microcontroller

If user wants to commonly develop program for Board ET-EASY168 STAMP in the format of AVR Microcontroller, user can do it by choosing any language that supports AVR MCU No.ATmega168 to write program by self. User can manage all resource systems internal ATmega168 suitably by self; in this case, there are 2 methods as described below;

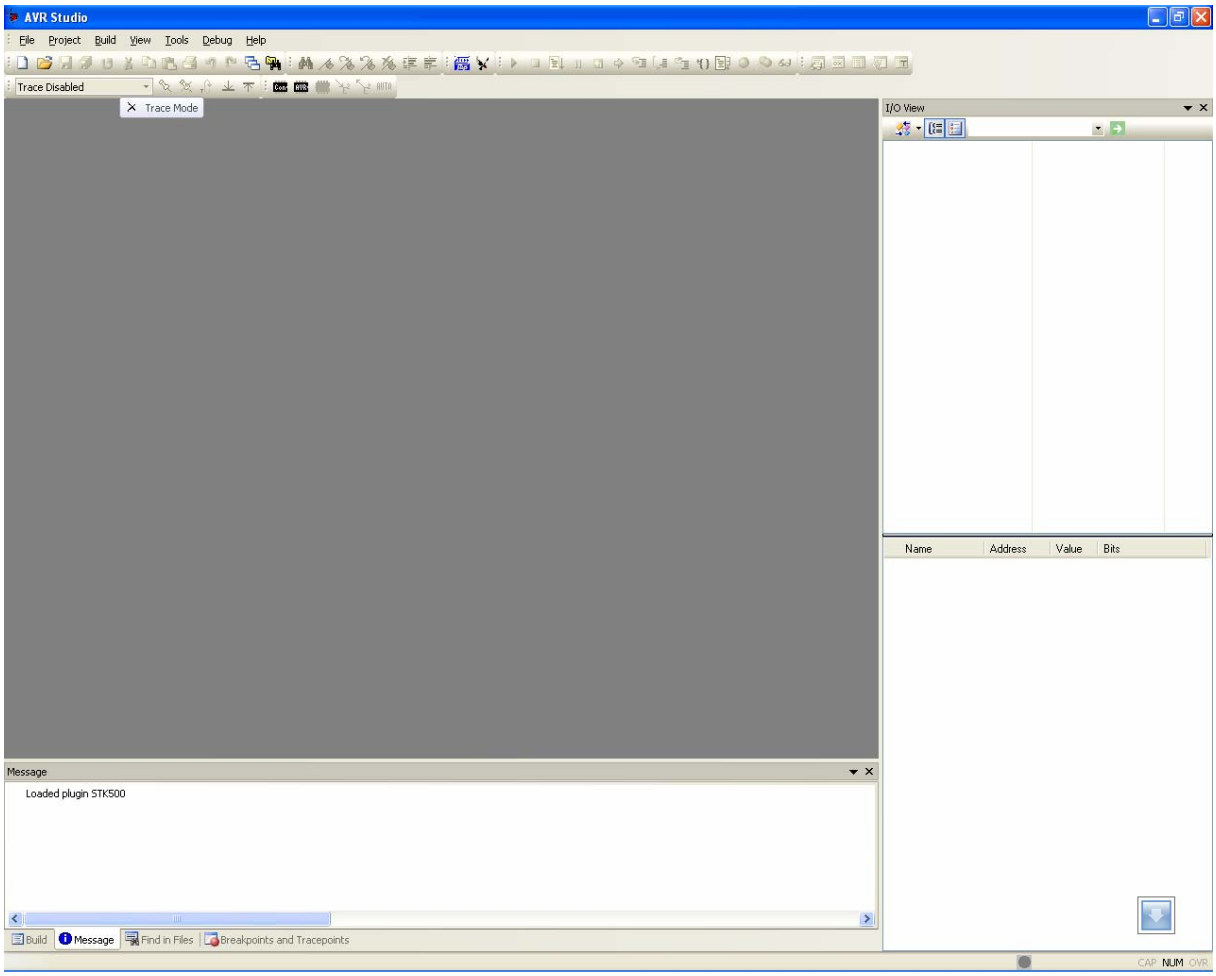
- **Program Development with External Programmer**: It is good method because it does not lose any resource; moreover, user can use and set the desired specification of resources internal MCU by self. However, it must have external Programmer to program Code into MCU. In this case, it can be used with any Programmer version that supports application of MCU No.ATmega168 and has standard AVRISP Connector of ATMEL.

- **Program Development with Boot Loader**: It is good method because user can program Code into MCU through Program Boot Loader instantly after writing program completely without using any external Programmer. However, there are some restrictions because it loses 2KByte Flash Memory (0x3800-0x3FFF) that is used to store Code program to install Program Boot Loader. Normally, Board ET-EASY168 STAMP has already been installed Program Boot Loader completely; so, user can write program up to 14KByte (from 16KByte totally). The position address of Code program must be written in the range of 0x0000 to 0x37FF (0x1C00-0x1FFF K Word). For SRAM, EEPROM and other resources internal MCU, user can use them as usual.

Example of Program Development with WinAVR by using with Boot Loader

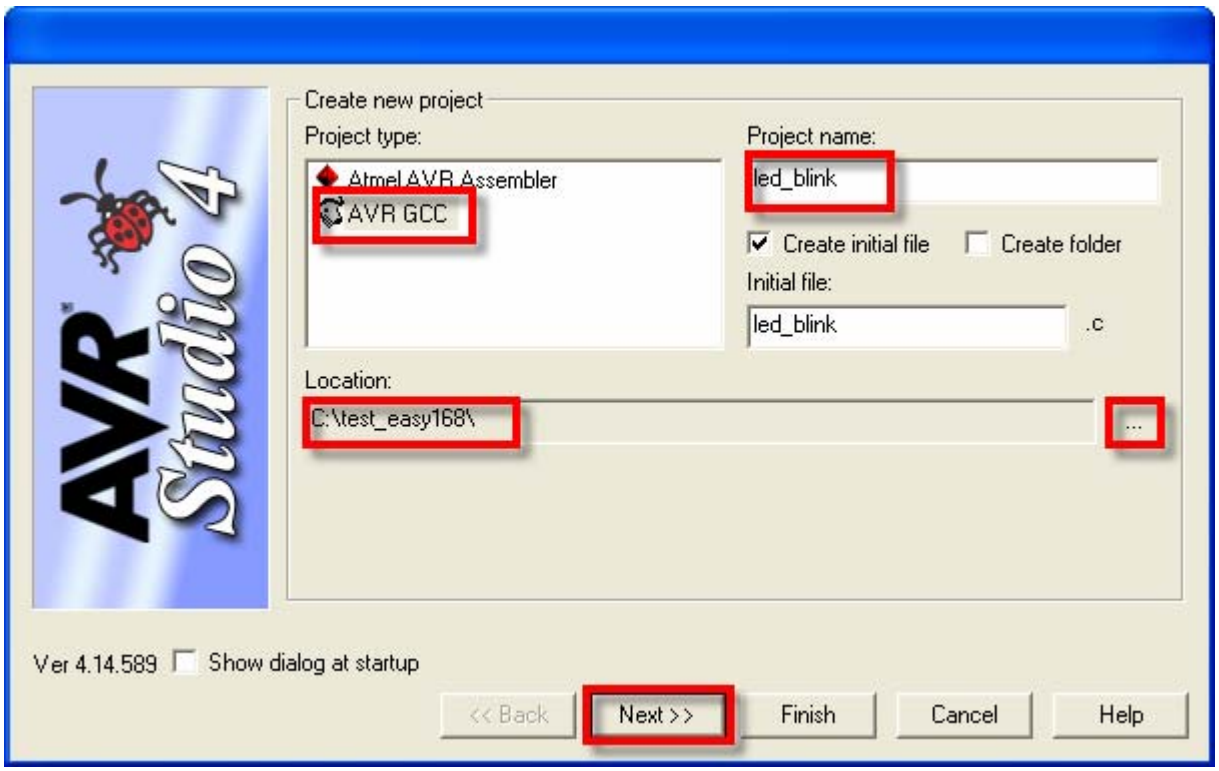
This example is the method to develop program of ATmega168 with C Language; in this case, it uses Program AVR Studio4 of ATMEL with C Language Compiler of WinAVR.

1. Run Program AVR Studio4.



2. Create new project, click Menu **"Project → New project"** and then setup options into program as follows;
   - Set **Project Type** to be **AVR GCC**.
   - **Location** for storing Project, please specify the desired location of Folder to store file and Code of Project. In the example, it is **"C:\test_easy168\".**
   - Specify the desired **Project Name**; in this example, it is **"led_blink"** and then also choose **Create initial file.** When specified the Project name completely, program will create file name as same as the specified project name automatically.

3. When setup options into program completely, click **Next.** Set **Debug platform** to be **AVR Simulator** and then set **Device** to be **ATmega168** as shown below;



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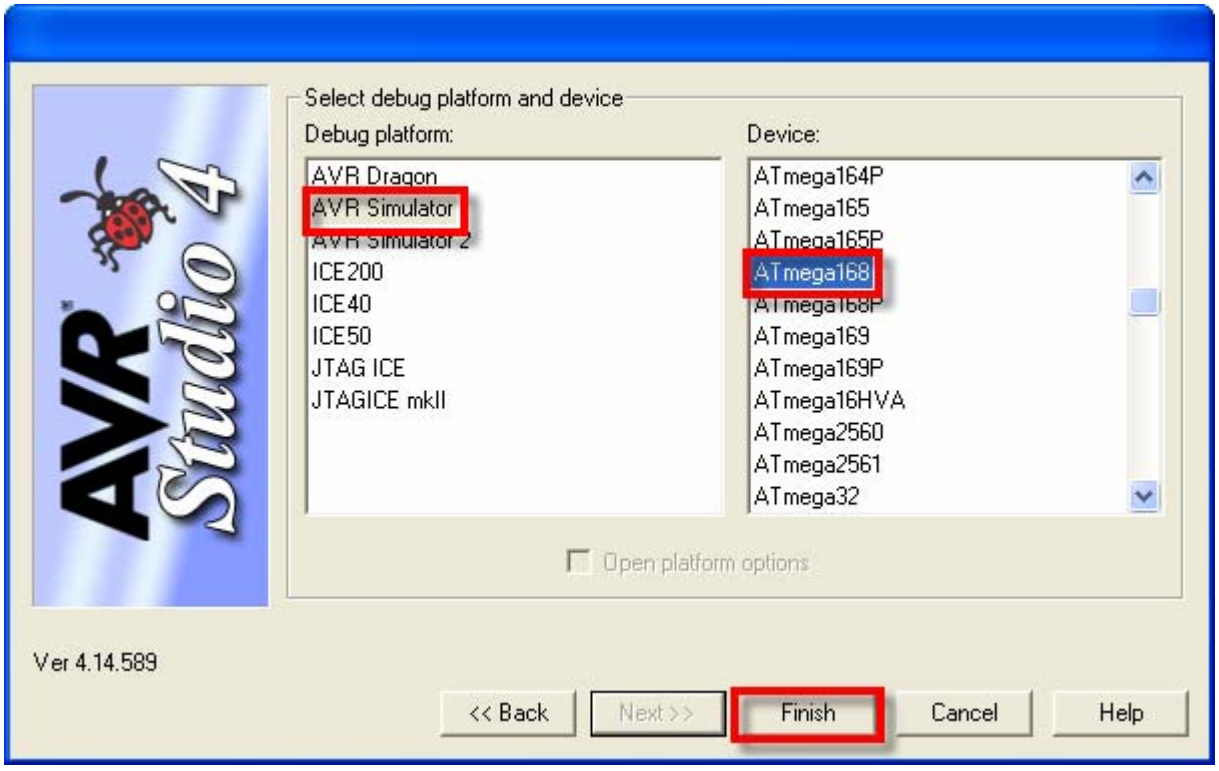
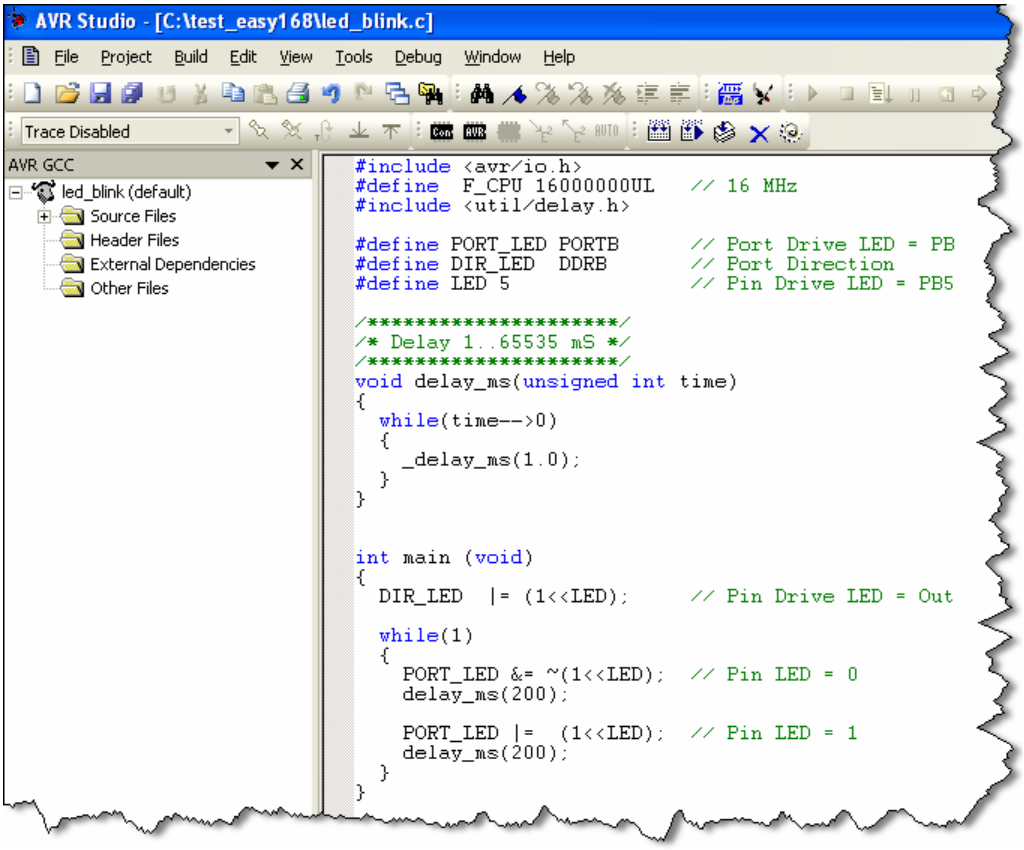
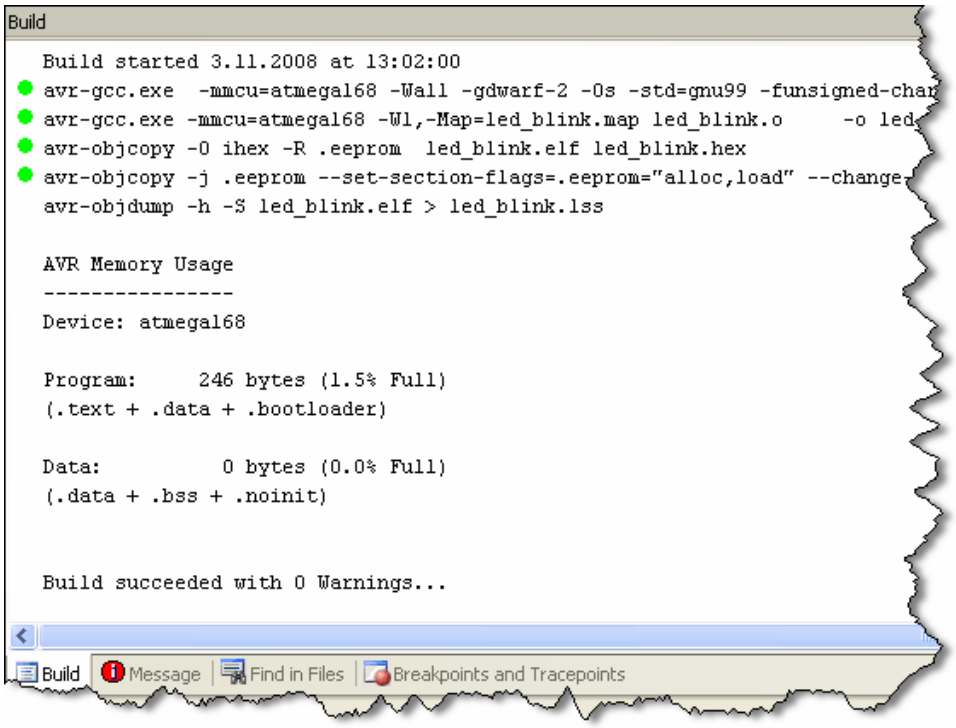


4. Type command of program in window **Text Editor** of program to test operation. In this case, it tests with Code Program for blinking LED at PB5 that is installed on Board ET-EASY168 STAMP as shown in the example below;

```
/*******************************/
/* Program Test LED Blinking  */
/* Board : ET-EASY168 STAMP   */
/* MCU   : ATmega168          */
/* X-TAL : 16.00MHz           */
/*******************************/

#include <avr/io.h>
#define  F_CPU 16000000UL     // X-TAL = 16 MHz
#include <util/delay.h>

#define PORT_LED PORTB        // Port Drive LED = PB
#define DIR_LED  DDRB         // Port Direction
#define LED 5                 // Pin Drive LED = PB5

/********************/
/*Delay 1..65535 mS */
/********************/
void delay_ms(unsigned int time)
{
  while(time-->0)
  {
    _delay_ms(1.0);
  }
}


int main (void)
{
  DIR_LED  |= (1<<LED);       // Pin Drive LED = Out

  while(1)
  {
    PORT_LED &= ~(1<<LED);    // Pin LED = 0
     delay_ms(200);

    PORT_LED |=  (1<<LED);    // Pin LED = 1
     delay_ms(200);
  }
}
```



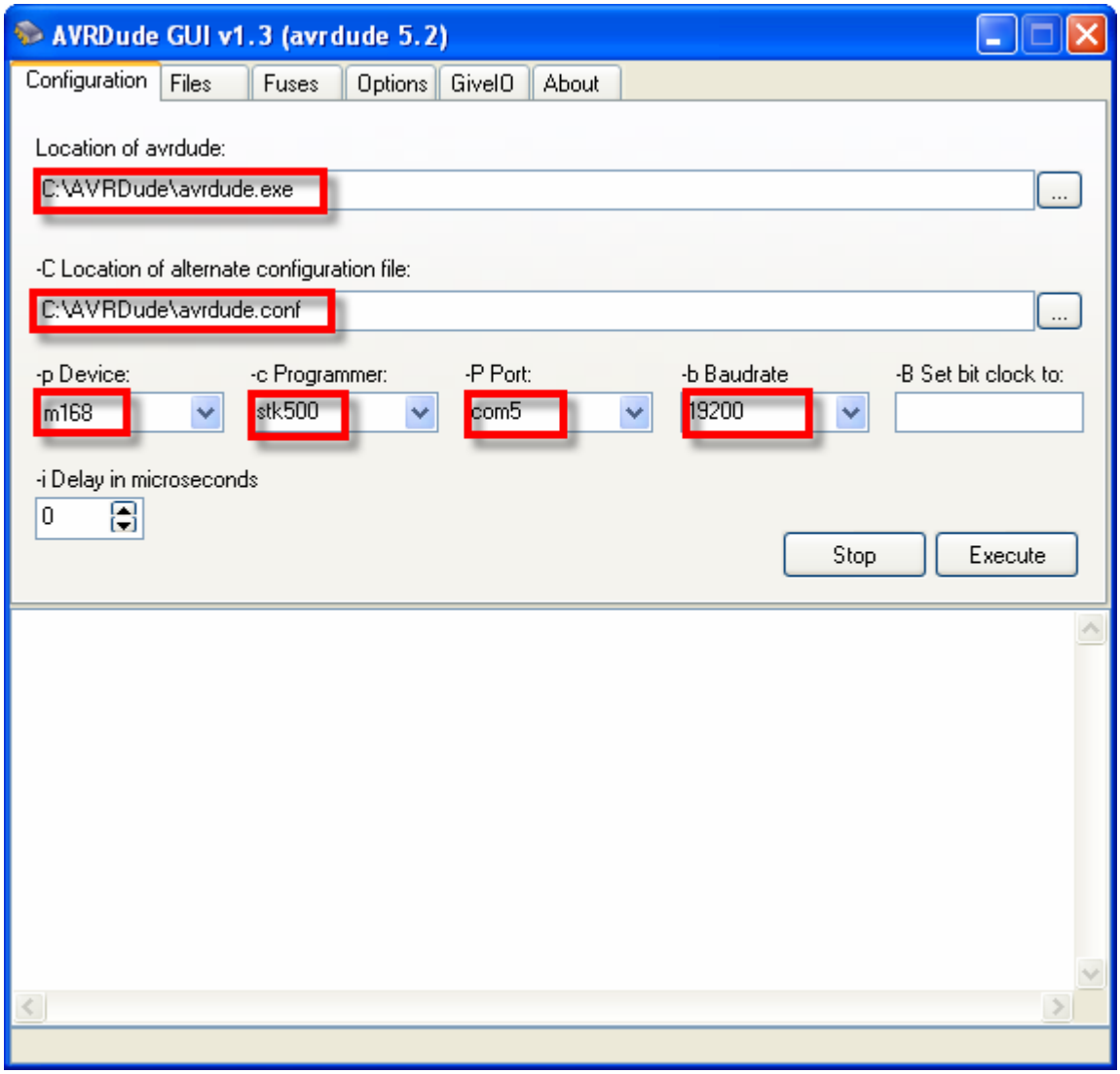
5. After typed Code program completely, compile program, click Menu **"build → rebuild all".** The compiling result will be HEX File that has the name as same as the created project name as shown below;


Build
Build started 3.11.2008 at 13:02:00
avr-gcc.exe -mmcu=atmega168 -Wall -gdwarf-2 -Os -std=gnu99 -funsigned-char
avr-gcc.exe -mmcu=atmega168 -Wl,-Map=led_blink.map led_blink.o -o led
avr-objcopy -O ihex -R .eeprom led_blink.elf led_blink.hex
avr-objcopy -j .eeprom --set-section-flags=.eeprom="alloc,load" --change
avr-objdump -h -S led_blink.elf > led_blink.lss
AVR Memory Usage
Device: atmega168
Program: 246 bytes (1.5% Full)
(.text + .data + .bootloader)
Data: 0 bytes (0.0% Full)
(.data + .bss + .noinit)
Build succeeded with 0 Warnings...
Build
Message
Find in Files
Breakpoints and Tracepoints

How to Program HEX Code into Board ET-EASY168 STAMP on Boot Loader

After wrote program, compiled commands, and got HEX File completely if user wants to program the compiled HEX Code of this program through Program Boot Loader of board for Program Development of Board ET-EASY168 STAMP in the format of AVR Microcontroller, we recommend user to use Program AVRDude through AVRDudeGUI as described in procedures below;

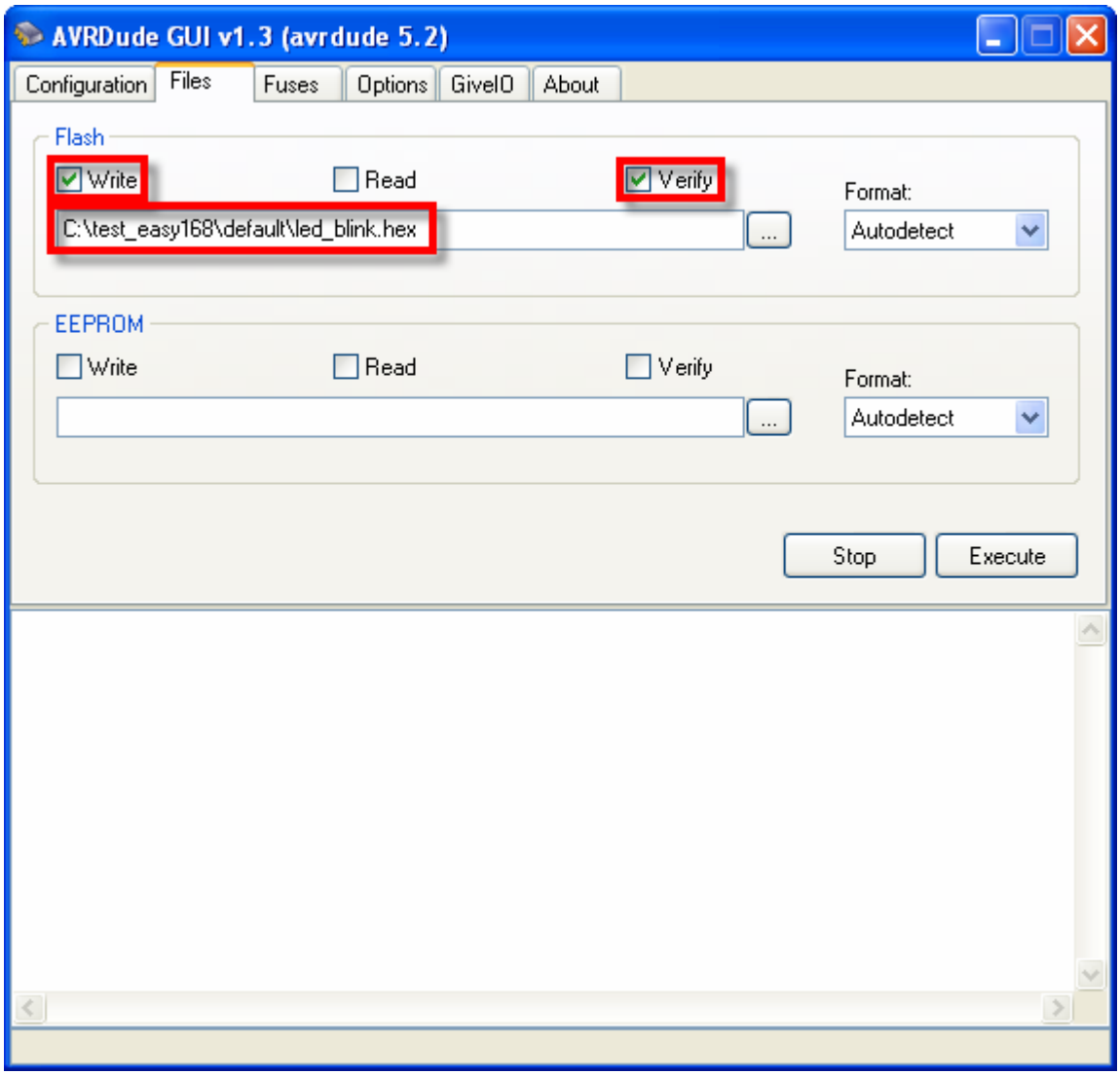
1. Create Folder name "**AVRDUDE"** in Drive C ("C:\AVRDUDE\"), copy program of **avrdude** and **avrdudeGUI** and then paste them in "C:\AVRDUDE\". In this case, there are 3 files; **avrdude.exe, avrdude.conf** and **avrdudegui.exe**.
2. Run **Program AVRDude.EXE**, choose **Tab Configuration** and then setup options as follows;



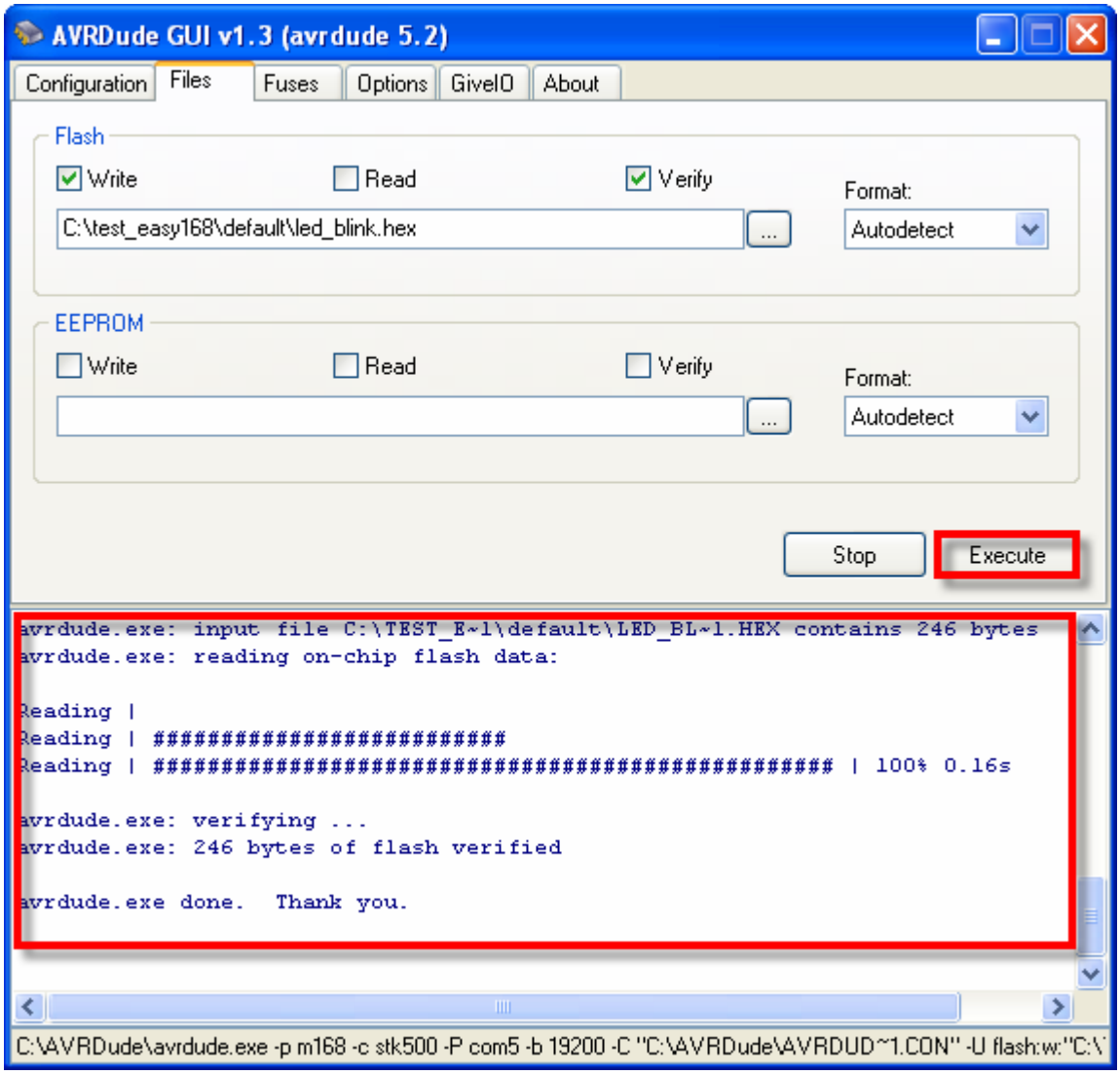
Setup Configuration values into Program AVRDudeGUI as follows;

- **Location of avrdude:** Choose name and location of file **avrdude.exe** that is installed in the step 1; in this case, it is **"C:\AVRDude\avrdude.exe".**
- **-C Location of alternate configuration file:** Choose name and location of file **avrdude.conf** that is installed in step 1; in this case, it is **"C:\AVRDude\avrdude.conf".**
- **-p Device:** Choose it to be **m168**.
- **-c Programmer:** Choose it to be **stk500**.
- **-p Port:** Choose Com Port Number corresponding with the Drive installation of USB(FTDI).
- **-b Baudrate:** Set it to be **19200**.

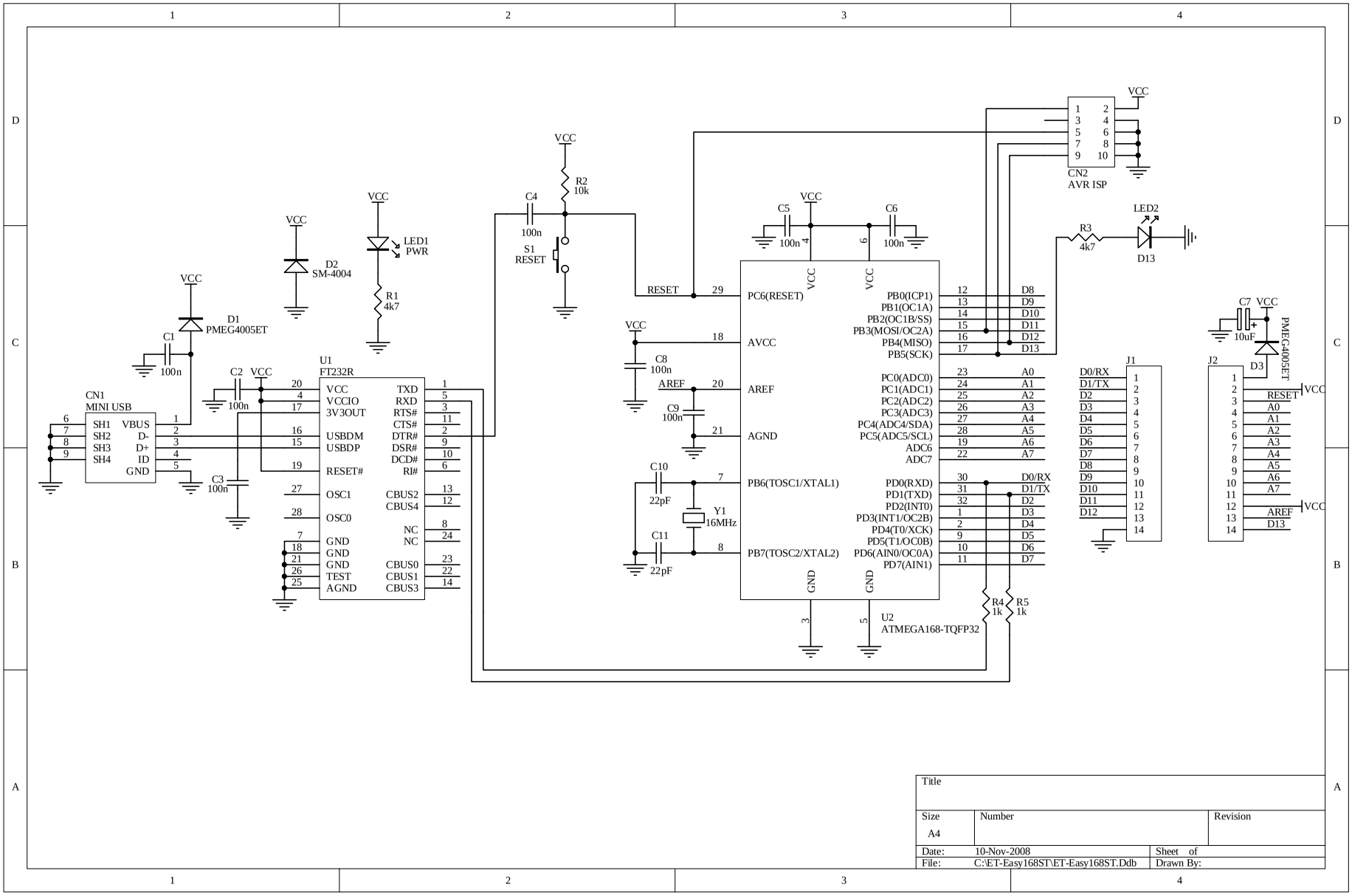
3. Go to **Tab File**, in the part of **Flash**, choose **Write** and **Verify** and then specify the desired HEX File name for programming. In this case, it uses HEX File from the example that is written by C Language of WinAVR and it is in **"C:\test_easy\default\led_blink.hex"** as shown below;



4. When setup values into program completely, choose **Execute** in **Tab Files**. Program avrdude starts programming HEX File into board instantly; in this case, user needs to wait for until the operation is complete as shown below;



5. After programming completely, please wait for 5 seconds and board will start running instantly. In this case, LED continues blinking and it alternates between ON and OFF endlessly. If user wants to test the new operation, try pressing RESET Switch on board and it makes LED blinking quickly 3 times and then ON. It means that it is in progress of MCU operation in Program of Boot Loader; if the program is not commanded to run in Program Code Mode of Boot Loader within 5 seconds, MCU will end the operation in the part of Boot Loader and then skip over to run in the part of Code of user instantly. Remember after resetting, it will always run like this. Program in the part of user starts running instantly after out of resetting status about 5 seconds.


CN1
MINI USB
SH1
SH2
SH3
SH4
VBUS
D-
D+
ID
GND
U1
FT232R
VCC
VCCIO
3V3OUT
USBDM
USBDP
RESET#
OSC1
OSC0
GND
GND
GND
TEST
AGND
TXD
RXD
RTS#
CTS#
DTR#
DSR#
DCD#
RI#
NC
NC
CBUS2
CBUS4
CBUS0
CBUS1
CBUS3
C1
C2
C3
100n
D1
PMEG4005ET
D2
SM-4004
LED1
PWR
R1
4k7
R2
10k
C4
S1
RESET
U2
ATMEGA168-TQFP32
PC6(RESET)
AVCC
AREF
AGND
PB6(TOSC1/XTAL1)
PB7(TOSC2/XTAL2)
PB0(ICP1)
PB1(OC1A)
PB2(OC1B/SS)
PB3(MOSI/OC2A)
PB4(MISO)
PB5(SCK)
PC0(ADC0)
PC1(ADC1)
PC2(ADC2)
PC3(ADC3)
PC4(ADC4/SDA)
PC5(ADC5/SCL)
ADC6
ADC7
PD0(RXD)
PD1(TXD)
PD2(INT0)
PD3(INT1/OC2B)
PD4(T0/XCK)
PD5(T1/OC0B)
PD6(AIN0/OC0A)
PD7(AIN1)
C5
C6
C8
C9
C10
C11
22pF
Y1
16MHz
CN2
AVR ISP
R3
4k7
LED2
D13
R4
1k
R5
1k
J1
J2
C7
10uF
D3
D0/RX
D1/TX
RESET
Title
Size
A4
Number
Revision
Date:
10-Nov-2008
Sheet of
File:
C:\ET-Easy168ST\ET-Easy168ST.Ddb
Drawn By: